AMERICAN MACHINIST

A JOURNAL FOR MACHINISTS, ENGINEERS, FOUNDERS, BOILER MAKERS, PATTERN MAKERS AND BLACKSMITHS.

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Valve Motion Diagram.

BY V. HOOK.

The writer was once in the employ of an engine-builder who was, originally, a civil engineer. He was deep in mathematics, and in laying out valve motions made use of sines, cosines, and no end of algebraical formulas. The p'an here presented originated with myself, and, in using it once in the presence of my employer, he termed it "fudging," and labored long with me to adopt his formulas. His labors were in vain; probably he thought he was casting pearls before swine. However, I was comforted with the knowledge that 999 out of a thousand mechanics would have preferred my diagram, with its "fudging." The practical man has no time for formulas when he can travel (to him) a much straighter road to what he wants. The plan is simple, and any one can understand why he does this or that; he knows he is right, and he has no conclusions to jump at.

The outside circle is the crank-pin circle, the smaller one the eccentric's center circle. The crank-pin circle is divided off into the inches of travel of piston, by a tram or pair of compasses set to represent the rod's length. S S, in Fig. 1, are the steam ports, E the exhaust port, and X X the bridges. Fig. 2 is a sectional elevation of the valve divided by the line *a d*. The valve drawing is cut out at the line *f e*, and placed on the line representing the valve-seat.

The laps and lead are laid off (from the pin C, the valve rod running directly from eccentric to valve) *a b* from center of circles, *a*. The line *b c* is erected perpendicular to center line F C, and through where it cuts eccentric circle at *c* a line is drawn, as *a* B. This line is the center line of eccentric, and the angle C *a* B—the angle formed by eccentric and crank *c*. This angle is constant in whatever position the crank-pin may be.

Place the valve, Fig. 2, on the seat, so that line *d a* coincides with line *c b*, and you have position of valve when crank is on center. As the crank moves, in direction of arrow, from C, the valve moves from right to left, and back again, till right hand edge of valve comes to edge of port, *z*. The steam is now cut off, and, to find position of crank-pin, notice that the line *a d* on valve cuts the center line, F C, at *b*, which, extended down to small circle, cuts it at *e*. The line *a e* D is now evidently the center line of eccentric. Taking the distance, B C, in a pair of compasses, and measuring back from D, we find the point A, which is the position of the crank-pin when steam is cut off. The figures on the large circle give the number of inches traveled when this occurs. The valve now continues to move from left to right till edge of exhaust cavity, *g*, comes to edge of port, *h*, when the exhaust commences. The center line on valve *d a* now cuts line F C at *a*; this, extended down, cuts eccentric circle at *m*. A line, *a m j* G, now represents the center line of eccentric; laying off the distance, BC, from G, we find the point H of crank-pin, when exhaust commences. The crank now travels on the lower half of its circle. The valve continues to travel from left to right, opening into the exhaust until the edge of exhaust cavity again comes to *h* (edge of steam port, the valve now traveling from right to left), the exhaust is closed and compression commences. This occurs, as before stated, when *g*, on valve, comes to *h*, on ports; the line *d a*, on valve, then cuts the line F C at *a*, and the line *a i* K represents center line of eccentric. Lay off from K the distance B C, and we find I, the position of crank when compression commences. Similar points on the opposite stroke can be found by commencing with crank-pin at F instead of C, noting that center line of eccentric is down instead of up. If the eccentric's motion is transferred to valve through a rocker shaft, the lap and lead must be laid off *toward* the crank-pin instead of from it.

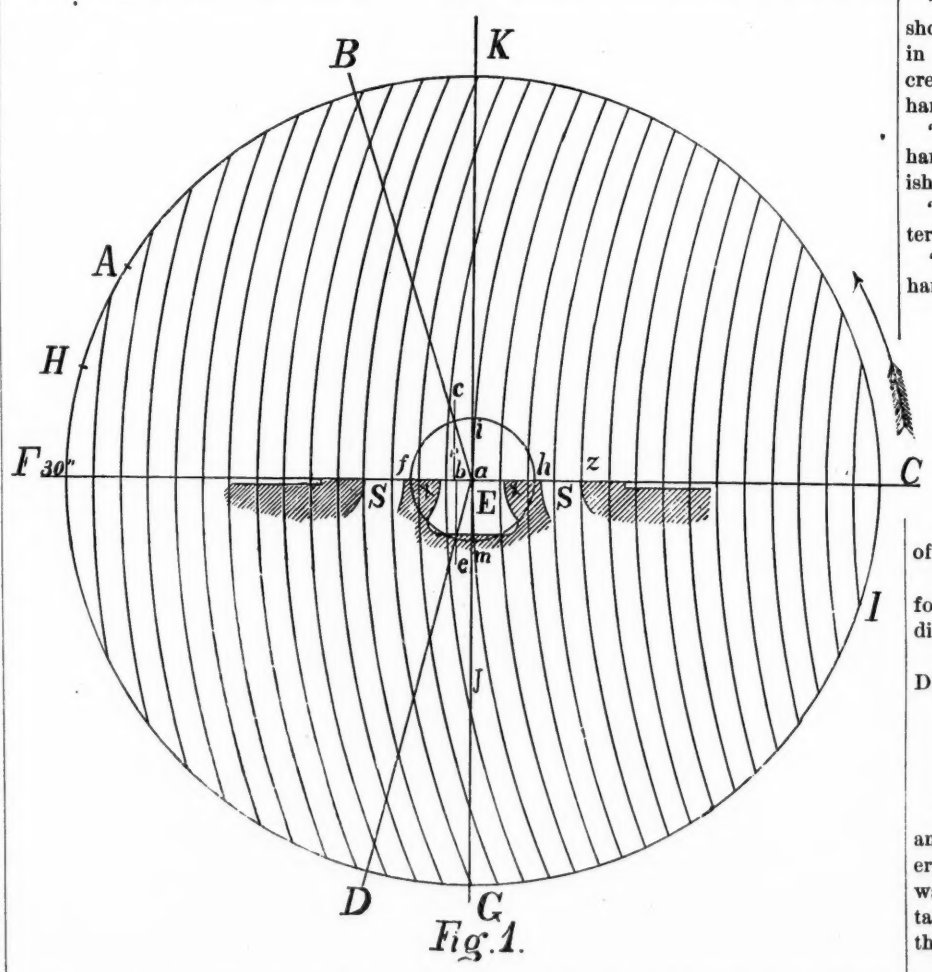


Fig. 1.

These points, I assume, are understood by the reader, as it would require too much space in one article to explain them all. The irregularity of the valve's motion (more expansion occurring on one end than the other) can be ascertained by this diagram. Unless the eccentric rod is *very* short, no notice may be taken of its irregularity due to radius (shown in line *b c*, being struck from length of eccentric rod), as it is so little that, generally, a straight line, as *b c*, will suffice for practical purposes.

I trust that this may be of use to some who have worried their brains with impracticable formulas and diagrams produced by men more scientific than practical, and which resemble puzzles.

In my next I will show how "motion curves" are produced, showing the entire movement of the valve, and its operation, at a glance.

Persons contributing articles for the AMERICAN MACHINIST will confer a favor by writing, in every instance, upon only one side of the paper. In case the preparation of finished drawings to accompany articles is inconvenient, a pencil outline, marked so as to convey the desired idea, will answer.

Extracts from Advance Sheets of a New Book on Mechanical Manipulation.

No. 1.

BY JOSHUA ROSE, M. E.

* * * The objections to the round top and bottom (Whitworth) thread are, that it requires to be cut by a tool having more than one tooth, and it is impracticable to make, by grinding, or with a file, a tool of this kind because of the liability to run in the curves at the top and bottom of the thread. Hence this mode is cut by a chasing tool cut by a standard hob.

Now the broad-cutting edge on a chaser causes it to spring or deflect, and hence to follow, to some extent, the texture of the metal of the work, dipping into the softer and springing away from the harder seams or spots in the work.

Again, suppose the hob to be quite true to pitch in the lathe, the hardening will alter the pitch, causing it, in a majority of cases, to get finer, but, in exceptional ones, to become coarser. Then, when the chaser is hardened, a second alteration of pitch takes place, inducing an error which we have, at present, no means of eliminating.

In cases where the screw cutting tools and standards require constant renewal (from excessive use), this assumes great importance. Suppose, for instance, a standard hob has its pitch .003 per inch of length, too fine (because of shrinkage in hardening), then the chaser it cuts will be .006—too fine a pitch—per inch of length, after hardening, and, if that chaser be used to make a new hob (when the original hob is worn out), the new hob will, when hardened, have its pitch .012 inch too fine in an inch of length.

It has been assumed, in this case, that the alteration of form due to hardening is, in each case, in the same direction—that is, to shorten the pitch. This assumption has been made because, in general, such is the effect, the amount, about .003 per inch of length, being that arrived at by eminent authorites upon the subject. Thus J. J. Grant gives the following replies to the accompanying questions:

"Do taps that shorten most in length (from hardening) increase the most in diameter in hardening?"

"Not always. Sometimes a tap that shortens by hardening becomes also smaller in diameter, while sometimes a tap will increase in length, and also in diameter, from hardening."

"Do taps that remain of true pitch after hardening remain true, or increase or diminish in diameter?"

"They will generally be of larger diameter."

"Do small taps alter more in diameter (in hardening) than large ones?"

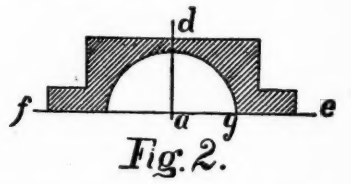


Fig. 2.

"No; the proportion is about .002 per inch of diameter."

"What increase in diameter do you allow for shrinkage* in hob taps for tapping solid dies?"

"As follows:

Diameter of hob tap.	Shrinkage about
¼ inch	.003
½ "	.003
¾ "	.005
1 "	.008

"Suppose a tap that had been hardened and tempered to a straw color contained an error of $\frac{1}{1000}$ inch, both in diameter and pitch, was softened again, would it, when soft, retain the same errors, or in what way would the softening affect the tap?"

"We have repeatedly tried annealing or softening taps that were of long or short pitch, caused by hardening, and invariably found them about the same as before the annealing. The second tempering will generally shorten them more than the first. *Sometimes*, however, a second tempering will bring a long pitch nearer correct."

The Morse Twist Drill Co. state as follows, in reply to questions:

"The increase in diameter of taps (due to hardening) varies with the diameter; a 1-inch tap would expand in diameter from $\frac{1}{1000}$ to $\frac{3}{1000}$ inch."

"Taps above ¼ inch diameter expand in diameter to stop the gauge every time."

"The great majority of taps contract in pitch during the hardening; they seldom expand in length."

"The shortening of the pitch and the expansion of diameter have not much connection, necessarily, though steel that did not alter in one direction would be more likely to remain correct in the other."

"There does not seem to be any change in the diameter or pitch of taps if measured after hardening and before tempering, and again after tempering them."

*The diameter of hobs decreases from hardening.

"Taps, once out in length, seem to get worse at every heating, whether to anneal or to harden."

As a practical example of how the errors induced by hardening the hobs may, in time, vary the thread of a tap, the following may be quoted:

The Freeland Tool Works have a set of hobs furnished by Sir Joseph Whitworth some thirty years ago. These hobs have never been sharpened or softened, and are, to-day, in first-class condition, having been but little used.

In the following table the diameter of taps made from chasers cut from these hobs are compared with those at present given by Whitworth:

Diameter at Top of Thread.	Diameter at Root of Freeland Taps.*	Diameter at Root of Thread, given by Whitworth.
1/4 inch.	0.188	0.1859
5/16	.2385	.2413
3/8	.2955	.2949
7/16	.388	.346
1/2	.3865	.3932
9/16	.449	.4557
5/8	.5035	.5085
11/16	.5665	.571
3/4	.6205	.6219
13/16	.6825	.6844
7/8	.728	.7327
15/16	.791	.7952
1	.8375	.8399

Here let it be noted that, as a rule, the diameter at root of thread given by Whitworth, in nearly all cases, is larger than that of Freeland's Whitworth taps, which accords with the average increase of diameter found by Mr. Grant's and the Morse Co.'s experience.

*These diameters were measured for me by the Morse Twist Drill and Machine Co.

New Vertical Engine.

The engines illustrated on this and opposite page represent two classes, viz., Fig. 1, yacht engine; Fig. 2, one for general work, which were designed and constructed to meet the demand for a cheap, durable, and efficient engine. The parts are well proportioned and the bearing surfaces large, thereby increasing the durability. They are also provided with a balanced piston valve, by which the friction incident to slide valves is almost, if not entirely, avoided. The frames are cast in one piece, and of such a shape that the greatest strength is secured with the least material, while they occupy the smallest amount of floor space. Each engine can be provided with a heater and pump (see Fig. 2) when required, which are of such a simple construction that they can be applied or removed with very little expense. The Waters governor is used on the engines for general work, unless otherwise desired.

The different parts are made perfectly interchangeable, therefore can be duplicated at any time. These engines seem to have met with a very favorable reception, both for steamboat and general use. Sizes are now manufactured from 10 H. P., 8″x″ cylinder, weight 1,800 pounds, up to 30 H. P., 10″x12″ cylinder, weight 3,500 pounds. The firm of Heald, Sisco & Co., of Baldwinsville, N. Y., are now manufacturing and introducing these engines. Their reputation in building the Heald & Sisco pumps will, no doubt, insure them success. They will gladly furnish, on application, any information required. These engines are named respectively, Mercury (10 H. P.), Queen (15 H. P.), Monarch (20 H. P.), and Vulcan (30 H. P.)

A brief biography of Thomas Blanchard, the inventor of the mechanical combination for turning irregular forms, has been recently published. Mr. Blanchard also invented a machine for cutting and heading tacks at one motion, twice as fast as the ticking of a watch, which was continued in use more than twenty years. This goes to explain why it is that the poor widow is able to buy, for 3 or 5 cents a paper, the tacks that the small boy, her son, sticks in the bottom of chairs for the unwary to sit down upon.

Advantages of High Speed Engines.

BY CHARLES T. PORTER.

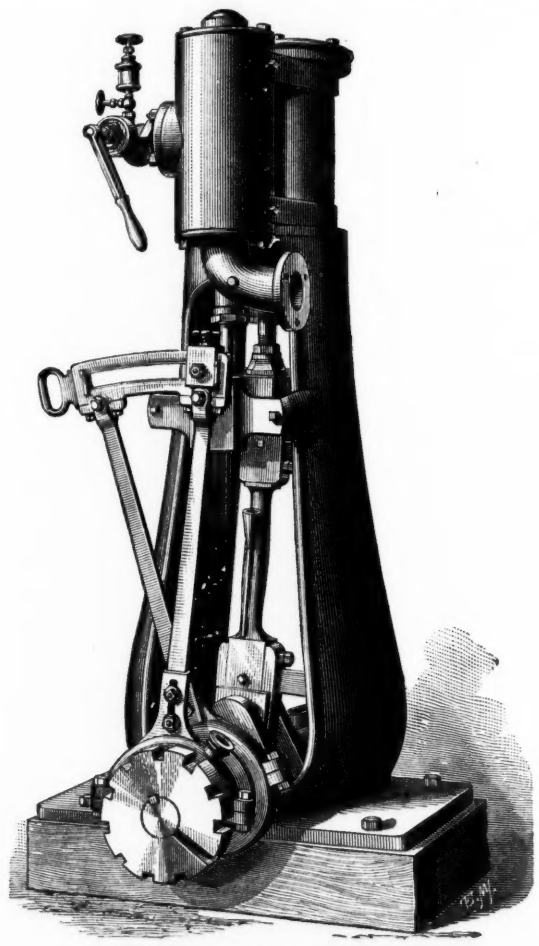
There are obvious features of the horizontal form of engine which adapt it remarkably well for the requirements of high speed.

The form of the bed and of the foundation, extended in the direction of the motion, and its proportions of base to elevation, are most favorable to stability.

It is a self-contained form, and the force of the steam is transmitted along a direct line.

The bed frame may be made as substantial, and as well adapted to resist deflection, as we choose to have it; and it is evident that for successful running at high speed it cannot be too stable and rigid.

But beyond these are the unseen things, and these are the realities with which we have chiefly to deal. Besides the force of the steam there are two other forces, which, whether considered or not, must in reality control the determination of the proper form of a high speed steam engine. These are the gravity and the inertion of the reciprocating parts and the crank.



IMPROVED YACHT ENGINE.

In any form of vertical engine the attraction of the earth resists the upward, and urges the downward movement of these parts. In the beam engine, however, they are divided and attached in nearly equal proportions to the opposite ends of the beam, and so the effect of their gravity is practically neutralized, the two portions balanee each other.

But when the motion is in a horizontal plane it is wholly unaffected by the action of gravity, except as this produces friction, which tends to retard motion in both directions alike.

If any one wishes to get a realizing sense of the comparative effect of gravity on horizontal and vertical motion, he can do so very readily by comparing the exercise of walking, or rowing a boat, with that of jumping up and down through the same distance. Horizontal motion is the natural motion of every creature on the earth, the limitation to this direction of motion becoming more absolute as the weight increases.

There are exceptions to all rules. For the steam hammer vertical motion is the very thing, but for the steam engine it is desirable that the force of the steam shall be equally effective in both directions.

The gravity of these parts of an engine is, however, of very little consequence at high speed, compared with their inertia. The former is constant at all speeds. The latter is hardly sensible in very slow movements, but increasing as the square of the revolutions becomes at high speed like a despot, who, unless his slightest demands are complied with, will destroy all within his reach. This force may be called the obstinacy of matter. It resists its being put in motion, and when in spite of it this has been done, then with equal vehemence it resists its being brought to rest.

Now, in the steam engine the reciprocating parts have got to be put in motion and brought to rest twice in every revolution; and so when any one tries his hand at building a high speed engine, he may rely upon finding this disposition of matter modestly, but firmly presenting its claims for consideration.

And now come forward the friends of Henry Betts, hitherto an unknown man, residing formerly in Norwalk, Conn., claiming that to him, and not to Thomas Blanchard, belongs the credit of inventing the machine for turning irregular forms. They also claim that Betts invented the lightning printing press, and that Hoe & Co. remodeled and improved it from his patterns, which were in their shops.

Also that Betts invented the portable forge for blacksmiths' use.

Letters from Practical Men.

Mr. Editor:

I must say that I am both pleased and instructed by reading the AMERICAN MACHINIST. I like its practical correctness—correctness is what is wanted in theory, so that when reduced to practice it will prove a success. A few words well said on any subject is better than a volume of theoretical bosh, that must consume valuable time to read without rendering an equivalent.

In a late issue of your paper you spoke of the general utility, and practical importance of the engine lathe. It is certainly a valuable tool, and one of greatest importance in a genuine machine shop. But I have worked many years in machine shops where *good work was done*, though engine lathes were almost unknown. But I have never worked in a shop where good filing could be dispensed with. Skill in this line is required in all shops. Without it the work of the engine lathe, or shaper, may be botched after it comes to the vise.

To prevent this, I will suggest:

1st. If the vise is not a parallel one, which most of those in use are not, close the jaws on the edges of a 2″ parallel strip, from 2 to 3 feet long, then set the vise with the strip perpendicular, and of such a height that when the workman stands erect, his elbow will just pass over the top of the vise, then fasten down solidly.

2d. Be sure to place the work square in the vise, then place the toe of the left foot 2″ front of a perpendicular with the mark in the vice, and the right foot 20″ behind the left. Stand firm on your feet, nearly erect, taking hold of the file with a steady nerve, with the elbow of the left arm bent slightly downward, the right arm moving close to the side, and don't drag the file on the backward stroke, but lift it almost clear of the mark.

The above rules are more especially for ordinary brass filing.

To become a good filer requires a great effort, and the practical experience of many years. I have been in the machine business over 46 years, and know something of the difficulties to be encountered in becoming a good filer.

Mr. Editor, the first time that you go into a machine shop and see a man filing, with one foot 6″ back of his vise, and the other three feet back of that, and his head on a horizontal line with the vise, his left elbow cocked up 6″, and the perspiration flowing freely—if you should have this article with you just hand it to the fellow.

Yours respectfully,

S. W. DAVIS,

Wilmington, Delaware.

Editor American Machinist:

Some of our old lathes were made with two sets of gearing for friction feed—one for feeding right hand, the other for left. Now we reverse by means of gearing in the head, which is simpler, besides being much superior in other respects. A few years ago one manufacturer made the worm of cast steel and hardened it. A hard worm is no improvement; besides, if not perfectly smooth it will cut the wheel like a file or cutter. The writer knows of a case where the teeth o the worm wheel were cut nearly half away in a few months by this means.

Perhaps the best arrangement now is a worm on a rod or slotted screw. This meshes into a worm wheel, which carries a friction disc on back side, and a small gear on its front, to which the handle or hand wheel is attached. This small gear meshes into a large one, and the large gear carries the back pinion. With this arrangement the carriage is easily moved by hand, and the feed readily applied. Now put an open and shut nut on the slotted screw, operated by a lever from the carriage apron, and we have a good thing.

To this we will only add that the gears connecting the spindle and the screw shall be so arranged, that the change of one gear will cut nearly all the common threads.

If any of your readers know of a better plan than the above, Mr. Editor, please invite them to send it along.

Yours, H. NORTON.

Bernardstown, Mass.

Editor American Machinist:

In a recent number of your paper I see you invite foundry men and moulders to send articles relating to their trades; and I think that it is a thing that we ought to take more interest in than we do, for there are a great many failures in moulding. It is rarely that we see anything in a paper that will benefit a moulder; but it is what we need, for there is so much in your paper on the steam engine, and other classes of work, that young, as well as old men can learn a great deal from what they read in your paper; and I hope that moulders who have any trouble with any class of work will write to your paper, and see if we cannot take as much interest in moulding as any mechanic takes in his trade. In this week's number there is a very good article on the casting of small steam cylinders. I would like to know how

to get a half square column straight from a straight pattern without taking it out of the sand until it is cool, casting from 12 to 20 feet long. What we want is some one to start to ask questions where they have a deal of trouble with their work, and then we shall be able to guard against a great many things that give us a great deal of trouble, as well as a deal of loss to our employers.

Yours,

A MOULDER.

INDIANAPOLIS, IND., Sept. 5th, 1879.

Editor American Machinist:

In your issue of Aug. 30th Mr. Wm. H. Hoffman says that double puppet valves "must be ground into their seats when hot, and at the same temperature that they work in, or they will leak." Now I beg leave to differ with him. The test of the pudding is chewing the string. I have ground in hundreds of them cold, and the first one was the only one that leaked. The only trouble is in making allowance for the *difference of expansion* between the *seat* and *valve*. I have ground them to work under a pressure of 150 pounds, and had no trouble with their leaking. Of course, it is a nice job, but it can be done. I also notice an item in the same issue that the Indianapolis Water Works are pronounced a failure. That is a mistake, and the report was started by interested parties. These works are of the Holly improved style, and can be changed from non condensing to condensing or compound in ten seconds, without stopping. The system is that of direct pressure. They are a *perfect success* in every sense of the word.

Yours truly, L. C. M.

SPRINGFIELD, MASS., Sept. 5th, 1879.

Editor American Machinist:

We enclose one of our time tickets that, for a jobbing shop, or any other, seems to leave little to be desired in its line. It does not relate to "pay day" at all, except as they are kept on file, and the month's wages computed from them—each one being approved by the the foreman checking it at the time.

Yours truly,

RICHARDS & DOLE.

Name, A. B.... Time, 10.... Sept. 2d, 1879.

Richards & Dole, Time Spring. Ticket.

BEGUN.	DONE.	H'RS.	WHOM FOR.	DESCRIPTION OF WORK.
7	11	4	G. P. Co.	Turning pulley.
11	6	6	H. Smith.	Repairing press
.....	.....	... ..	.....	.....
.....	.....	.....	.....	....
.....	.....	.....	.....	....

Concerning Mechanical Mistakes.

Editor Machinist:

I noticed in your issue of the 13th of August, a communication from V. Hook, in which he treats me to a great deal of censure in regard to instructions contained in one of my works for reversing engines. The omissions of some writers are frequently a Godsend to others, as it gives them an opportunity to magnify mole-hills into mountains, and at the same time to ventilate their own peculiar theories. He starts out to discuss the subject of small castings for steam cylinders, and winds up by informing us that he has discovered an error in one of my works on the steam engine, though the case cited bears no relation whatever to the subject he was discussing. I have often thought that those who make mistakes themselves ought to be the most tolerant of others, but such does not appear to be the case with him. If V. H. had examined the book referred to, a little further, he would have found the subject explained correctly and illustrated with a diagram; but now, that he has seen fit to include different subjects under one head, he certainly can not object to others following his example.

Though V. Hook styles himself an "expert," it does not appear from his own statements that he is actually such, or that he is even a success as a moulder, as he informs the readers of the MACHINIST that he had moulded seven steam cylinders in succession and lost them all. There is not an apprentice boy in this country, with two years' experience in founding, that would willingly subscribe to such a declaration, as it is well known that hundreds of sets of castings for small steam engines are sold in the country every year, some with cylinders not over two inches in diameter with the ports cast in. If V. H. would take the trouble to call at these headquarters I will guarantee to have one half dozen cylinders, of one-and-three-quarter inches in diameter, moulded and cast within two hours, and show him that casting the ports into small cylinders is just as easy as rolling off a log, to those who know how.

But whether he does or not, I wish to call his attention to the fact that the set of diagrams with which he illustrates his subject, entitled, "Remodelling Valve Motions," which appeared in the issue of Aug. 2nd, are fac-similes of a set used by Louis Eikenberry a mechanical engineer, who applied cut-offs to steam engines, in Pennsylvania, twenty years ago; they correspond exactly to Mr. Eikenberry's drawings and model. Now, in relation to V. H.'s instructions for setting up engines, which appeared in the MACHINIST of the 16th of August, it may be asserted that no practical mechanic in this country would subscribe his name to anything so rude and primitive. He informs us that the first requisite in setting up a stationary engine, is a template, six inches wide, and that it is merely a frame large enough to take in the holes in the bottom of the bed plate. Now it is generally admitted that the template should be a fac-simile of the bottom of the bed plate; that being the case, in some designs of engines, it would require to be fifteen inches wide, while in others it would not need to be over four. Nevertheless V. H. informs us that six inches will answer in all cases.

Our author next tells us that the template and foundation bolts should be squared (by the lines b. b. or c. c. on the diagram, which he introduces) to the shafting, if up, or to the building, but he does not give any instructions how to do it. The countershaft, on which the driving belt is intended to travel, may be in the second or third story, or the engine may be located outside of the main building. There are no instructions given how to find the lines, in either case, or even the line of the building, which is information of great value to many inexperienced persons, who undertake to set up engines. In regard to the excavation, or "foundation hole," as V. H. terms it, we are given no information as to whether it should be the same depth in all cases, regardless of the size of the engine or the character of the soil; how much wider or longer the foundation should be than the bed plate when laid up to the proper height; how to find the position of the off pillow-block; how to place the fly-wheel on the shaft; how to level the bed plate, and ascertain if the cylinder is at right angles with the crank pin, in all positions.

The reader is next informed that engines of any size may be set up without templates, by simply placing them level and square on the foundation, after which holes may be drilled in the brick or stone, stud-bolts inserted, and lead or sulphur poured in to fill them up. Now it is well known to all experienced mechanics that the advantages of sulphur as a foundation for steam engines and other machinery, are that it enters every crevice, and is influenced less by the changing of temperature than almost any other known mineral; but when once placed it must not be disturbed, since, if it is, it will immediately crumble. Now the idea of placing a round stud in a round hole and filling it in with sulphur is ridiculous, as the very first attempt to screw down on the nuts, for the purpose of tying the bed plate to the foundation, the studs would turn round in the holes, when there would be profanity *ad libitum*, as V. H. would say. Lead will answer no better purpose, unless it can be caulked round the stud, and even then, it would not hold a round bolt in a round hole; in any case it would become loose by expansion and contraction, resulting from the heat imparted by the engine. It is customary with practical mechanics, when it becomes necessary to drill holes in foundations for the anchor bolts of steam engines, or other machinery, to drill a hole at right angles from the outside, and insert a key in a corresponding slot in the end of the bolt.

In answer to V. H.'s query as to what good my thirty years experience has been, either to myself or to my readers, I beg leave to say that I am the author of six works on the steam engine, and was the first writer in this country who wrote a series of practical handbooks on the steam engine for American engineers. Many of the most promising engineers of the country, both on sea and land, and in the U. S. Navy, have been my pupils; besides there is hardly a subject in the whole range of steam engineering, on which I have not written for the instruction of those members of the engineering fraternity whose education has been limited. *Query*? Of what practical value is V. Hook's experience to himself, or the readers of the MACHINIST, when, in an attempt to mould, he lost seven pieces in succession, when he knows no better method of securing a round stud-bolt in a round hole, than by pouring in a little sulphur, and when he has to vamp-up other men's ideas and palm them off on the readers of the MACHINIST as his own.

STEPHEN ROPER.

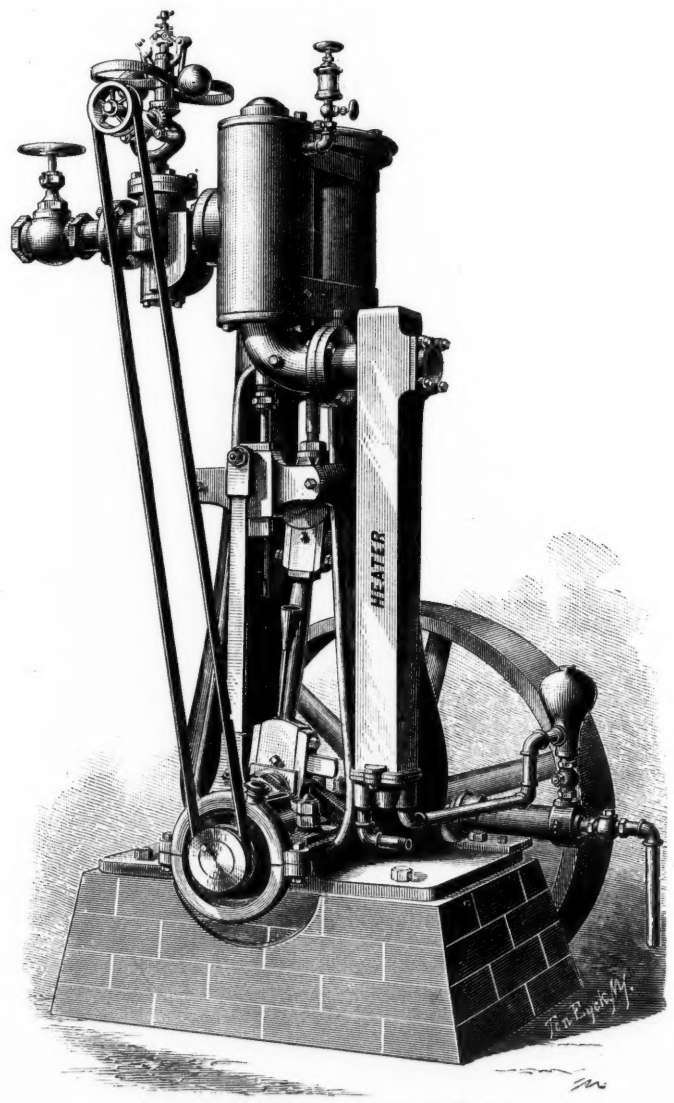


FIG. 2.—IMPROVED VERTICAL ENGINE.

An English newspaper, the Liverpool *Daily News*, has for a year past used four type-setting and seven distributing machines, at a saving of about $3,000 per annum, as compared with the same amount of work by hand. The compositors working the machines earn better wages than their fellows at the case, while the saving to the establishment is over thirty per cent. The machines are used for every kind of composition except tabulated and displayed work, the matter being set, spaced and justified with greater accuracy and rapidity than by hand labor. Each machine costs $750, and the average speed is 6,000 ems per hour.

We notice considerable quantities of American carriage goods are finding their way to Germany, and we trust the trade will increase. The British West Indies also appear to furnish a good market for American goods, and our manufacturers will do well to foster and encourage it all in their power. Many manufacturers of carriage goods have distributed their catalogues very freely in Cuba and the South American States, yet we notice that very few carriage goods find their way to those countries from this place. *The Hub* has always contended that the last-named countries were not yet ready for this class of goods, and the monthly tables we are printing bear evidence of this fact. We are sending large quantities of carriage materials, as well as many carriages, to the British possessions in Africa. A careful study of the table of exports of carriage material leads us to believe that our best markets, for years to come, will be among English-speaking nations.—*The Hub, Sept.*

Messrs. Goffinon & Barbos, of Paris, France, have lately introduced into their building the American system of heating, the radiators for which they imported from New York, and which are probably about the first of that peculiar type used upon the continent.

Among the novel applications of glass is the invention of Hamilton L. Bucknill, of England, who has recently patented in this country a railway sleeper made of cast glass.

A man was brought into court on the charge of having stolen some ducks from a farmer. "How do you know they are your ducks?" asked the defendant's counsel. "Oh! I should know them *anywhere*," replied the farmer, who proceeded to describe their peculiarities. "Why," said the prisoner's counsel, "these ducks can't be such a rare breed—I have some very like them in my yard." "That's not unlikely, sir," said the farmer; "they are not the *only* ducks I've had stolen lately." "Call the *next* witness."

There never was any lack of unemployed assistant book-keepers in the country. The woods swarm with young men who are anxious to live in town and keep books. Let some agriculturist insert an advertisement in a newspaper for a young, vigorous gentleman to go a short distance into the country to plow corn and curry horses, and he will be apt to conclude that there is nobody in want of a job.

Steam Condensation and Pressure.

Mr. Editor:

Referring to Mr. Dunbar's article in your issue of August 30th, criticising mine of the 16th, let us see how much the condensation would affect the pressure at the engine. Suppose there were 100 feet of 6 inch pipe to feed an engine, one half in a boiler-room temperature of 100°, the other in engine room at a temperature of 60°, and none of the pipe covered.

Shut the steam from the engine and the only motion of steam in the pipes would be to supply the condensation. Now, find the difference in pressure in the boiler, and in the pipe near the engine, and the difference is due to condensation.

A steam gauge, or indicator, would not be sensitive enough to record it; but run a drip-pipe from the main pipe to the boiler; attach a water gauge to the pipe at the height of the water gauge in the boiler, and note the difference in the water levels. If the difference was 1¼ inches it would show a loss of less than one ounce, for a little allowance must be made for friction of water returning into boiler.

The amount of condensation, I should think, would be from one to one-and-one-half pounds, or pints of water per minute, and to supply this through a 6 inch pipe would make but a very slight loss of pressure. The loss in fuel would be something, and perhaps it would show some re-evaporation in cylinder, but I think when the perfect engine comes, with perfectly tight valves and piston, we shall not be troubled so much with re-evaporation. We will consider that again hereafter.

Mr. Dunbar also thinks there might have been an error in diagrams, from the momentum of pencil-carrying parts of the indicator. Let us see how far that would affect the diagram from steam pipes.

In the first pair of diagrams with speed 160 revolutions, the diagram from cylinder shows vibration at the commencement of stroke, which is undoubtedly caused by the momentum. In the diagram from the pipe, the pencil moves about one-tenth as far as in the diagram from cylinder.

[For convenience of reference, we reproduce Mr. Robbins' diagrams from our issue of August 16.—ED. A. M.]

As the momentum of like bodies moving at different velocities are to each other as the square of the velocities, we have only one hundredth part the momentum in the pipe diagram. I forgot to call attention to the fact that the increased piston speed at the back end of cylinder, caused greater friction of the steam in the pipe, and shows a lower initial pressure in cylinder than the front end. (Locomotive engineers will please remember that the back end of a stationary engine is the same as the front end of a locomotive).

Comparing the other set of diagrams from engine, 20″×48″, at 57 revolutions, with Mr. Dunbar's test of an 18″×42″ Corliss, at 70 revolutions, which showed a loss of 3 lbs. pressure; and as it is a smaller engine, larger valve, and being an angle valve, only gives half of the friction, also shorter pipe, and less turns, I see no reason to believe that both tests were not correct ones. Presuming that when the engine took steam at full stroke it was throttled, and only during the same labor, or when cutting off short, it is easy to believe there was no perceptible loss of pressure to be seen.

The danger of errors in taking diagrams is so great, that I do not wonder that experts do not place great reliance on any they have not taken themselves, and especially if the diagram seems to show anything different from what they have found by their own experience.

There may be friction of piston or joints—lost motion in the joints—the lever, cord, and pulleys may be so arranged as not to give a motion of paper drum corresponding to that of the piston.

If a high speed engine is being tested, the momentum of drum and other rotating parts, or the elasticity of the cord, may make the diagram too long, and incorrect at each end, and where it is most important, it should be correct. There may be a slight motion in the carrying pulley, or to some stick where it is attached. There may be water in the engine cylinder, or the indicator cylinder, and the diagram distorted in consequence, Also the pencil may be pressed so hard as to record an error by the friction.

These are some of the chances of errors, and yet I think that after a little practice, persons who are not experts at the business (and it includes your humble servant in the number) may avoid these errors.

I think there is often too much friction in the pencil, and that almost always the diagram varies a little from truth from that cause.

Now, to test this, let any one attatch an indicator and a steam gauge to the city water pipe. There will almost always be a slight vibration of pencil and pointer. If not, it can be made by starting and stopping the water at some faucet. Now, when the vibration is only one or two pounds, press the pencil to the paper as you have been accustomed to in taking diagrams. If the pencil remains stationary, and the pointer in gauge vibrates one or two pounds, try the pencil still lighter, and see, if with a variation of one pound only, you can hold it light enough to make any mark that can be seen. I have not been able to do it.

This friction, and the momentum can never be wholly done away with.

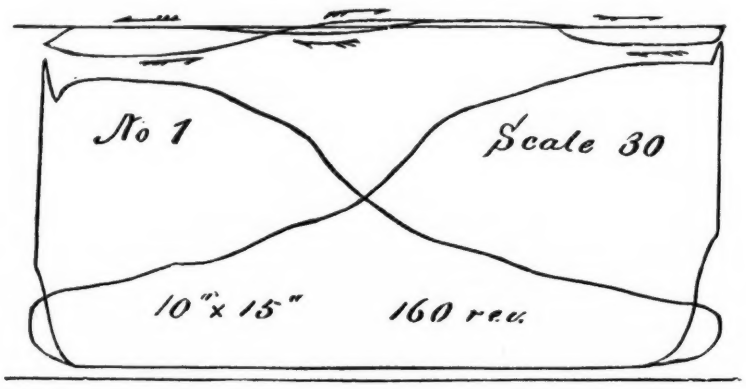
One counteracts the other to a certain extent, but varying constantly as circumstances are changed. Suppose two indicators to be attached to a cylinder, both correct, the one with a 20 spring, and making a diagram not over 3 inches long; the other with a 40 spring, and making a diagram 5 inches long. Let the boiler pressure be 40 lbs., so as not to be too great for the 20 spring, and the load, so as to cut off at about ⅛th of stroke.

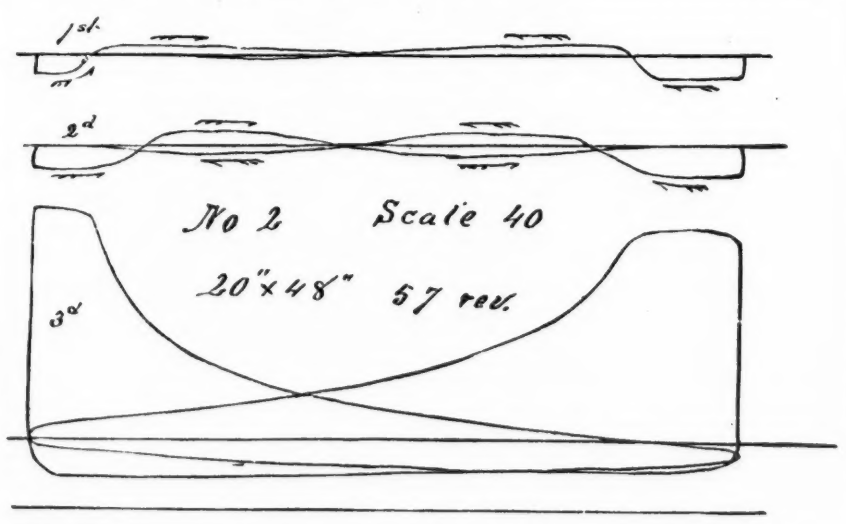
Now, take a diagram from same end of cylinder, and same stroke with each indicator, and run out the theoretical expansion lines, and, in my opinion, they can never be made to run alike. I think there will be more *re-evaporation* on last part of stroke accounted for in the diagram with 40 spring than the 20; and that it will in part be due to the necessary friction of pencil.

I have never tried it, but should be glad to hear from Mr. Church, or any one who has tested it.

Now, Mr. Editor, in expressing my opinion, I want it understood that I am not a civil or mechanical engineer, and do not wish to be classed as a teacher, or expert, but rather one of the scholars among your numerous class of readers, who would like now and then to recite his lesson, and would be glad to have all errors corrected, from either teachers, or fellow scholars.

E. H. ROBBINS.





A large number of establishments in and about Pittsburgh that formerly used lump coal for manufacturing purposes now use nut coal, and many of them now use slack that formerly used nut coal.

Canada has ordered from English mills 65,000 tons of steel rail, some of which are to be delivered several months ahead.

Gleanings from the Foreign Press.

THE FORGING OF CRANK-SHAFTS.

The following paper, says the *Ironmonger*, read by Mr. W. L. E. McLean, of Glasgow, at last week's meeting of the Institution of Mechanical Engineers, describes the method of forging marine crank shafts adopted at the Lancefield Forge, Glasgow. The piece is begun from the stave in the usual way, with the slabs all welded however on the flat, till a basis is formed for the building up of the crank. A portion is roughly rounded to form the one end of the shaft, and the butt of the crank will present the appearance of a slightly elongated square. The workman then "scarfs" or hollows it down at one edge all along the side; it will then present the appearance of being somewhat bulged outward at the two points. Three long thin slabs, forged and shaped for the purpose, are then placed on the hollowed part, the piece lying flat in the furnace. These slabs are tapered a little the breadth way, not on the length, and little pieces of iron are interposed between them, to keep the surfaces apart, and allow the flame free access between them. The object of making them thin is that they may be all equally heated, which is not so readily achieved when the slabs are thick; and the object of the tapering is to allow the slab to flow out freely when the uppermost slab is struck by the steam-hammer. The surfaces thus get solidly welded. The slabs are forged long enough to go right across the whole width of the crank, excepting about six inches; this margin is necessary to allow of the lengthening out of the slabs to the whole width under the process of forging. After these slabs are perfectly welded, the piece is turned upside down, and the process is repeated on the other side. When welded down the mass has increased in depth as well. Another scarfing takes place on the first side, and then another on the second side, and so on, till the full size is obtained; and it will be seen that by this process of "scarfing" equally from both sides, the iron from the very middle of the body of the shaft is drawn up quite to the crank-pin. It will be seen that by no possibility can there be a "scarf-end" in the crank-pin, as the slabs in all cases go right across the crank, and also that the cheeks of the cranks have no edge weldings crossing them, as in the previous cases. The fiber is also developed by the continuous drawing up of the iron consequent upon the repeated flat scarfings across the whole width of the crank. When the crank has been thus massed sufficiently large, it is cut at the gable, with sufficient material left to piece out the other body of the shaft. This is now done, the coupling welded on, and a small stave drawn on the end to enable the forgeman to manipulate it, when it is turned end for end, to complete the other end. These proceedings occupy longer time than either of the two ordinary methods, and consequently cost a little more; but the advantage is well worth all the difference, as greater confidence can be entertained that the forging is every way satisfactory. In brief, by making the crank first, is avoided the liability to weakness at the neck, characteristic of the forgeman's making the shaft before him, as in one ordinary method; by the repeated "side scarfings" is avoided the liability to fracture across the cheeks, consequent upon the edge weldings of both the ordinary methods; while by having the slabs the whole length of the width of the crank any "scarf end" in the length way of the crank-pin is impossible; and the welding of the mass of the crank being wholly on the flat must tend to form a more solid forging than if hammered otherwise. Thus, if the forging is well heated and properly hammered, the system promises to ensure that no weak part will be found in the shaft after it is finished and put to work. The writer believes, from the success which has already followed in every case the adoption of this method, that it will eventually be found that almost more depends on the mode in which a crank-shaft forging is constructed than on the material of which it is made.

TECHNICAL EDUCATION.

At the last meeting of the British Association Professor Sylvanus P. Thompson read an able and valuable paper on "Apprenticeship Schools in France," urging that in England more attention should be paid to the important subject of educational apprenticeships. He said the system of apprenticeship, as it has existed in England and on the Continent, is falling into decay from social causes, which render the education of the apprentice at the hands of his master impracticable. The question of apprenticeship is one of the knotty points of technical education, and involves the following problem:—How to give to artisan children (in the skilled industries) that technical training and scientific knowledge which their occupation demands, without detaining them so long at their schooling as to give them a distaste for manual labor. Four distinct solutions of this problem are possible—1. Send the children to work in the factory or workshop before their primary education is completed, making it obligatory all through their apprenticeship that they should have every day a certain number of hours' schooling in a school in the workshop, or attached to it. 2. Keep the children at school as long as their education is unfinished, but set up a workshop in the school, where they shall pass a certain amount of time every day, so as to gain at least an aptitude for manual labor. 3. Organize a school and a workshop side by side, and co-ordinate the hours given to study with an equal number of hours devoted to systematic manual labor. 4. Send the children half the day to the existing schools, and the other half to work half-time in the workshop or factory. Illustrations of all these systems are to be found in Paris. Of the first type there are no fewer than 237 in France, of which the schools of

M. Lemaire and of MM. Chaix (in Paris) may be taken as excellent examples. Of the second type of apprenticeship school is the Ecole Communale d'Apprentis, in the Rue Tournefort, Paris. This is an ordinary elementary school, having workshops attached to it, and used for about three hours a day by the lads. The third type, which is *par excellence* the apprenticeship school, is well illustrated by the Ecole Municipale d'Apprentis of the Boulevard de La Villette, Paris, and by the Ecoles d'Horologerie of Besancon and of Cluses. Statistical tables were given of the attendance at these schools, of the education given, of the capital and current expenditure per pupil, and of the results attained. Fourth type: Half-time schools are rare, and not very important in their results. The author conceives that there is room for schools of all these different types to exist side by side in all large manufacturing centers, though schools of the first and third types are probably best suited to the conditions of British industry. The author claims to have established, by facts drawn from the experience of the French schools—1. That the systematic instruction of apprentices in the skilled industries is possible. 2. That it can be effected in several different ways. 3. That apprenticeship schools of one or other type afford a most satisfactory and economically sound way of attaining this result. 4. That this new apprenticeship solves the knotty problem of technical education which arose out of the decay of the old apprenticeship.—*The Ironmonger.*

The shops of Detroit, Mich., are all fairly busy, and orders increasing. Pattern-makers and moulders hard to find, and machinists and engineers are all engaged at fair wages, very few mechanics being out of employment in any branch of trade.

Road locomotives are coming into considerable use in France. One of twelve tons weight recently dragged a piece of artillery of forty-three tons from Vincennes to the Point d'Austerlitz.

A machine for spherical printing has been perfected by a Philadelphian, by which a band of color or of plain or fancy printing can be placed on cylinders or spheres of any size with unfailing accuracy and in an exceedingly rapid manner.

Many coal-mine explosions which have been thought mysterious probably resulted from the sudden burning of dry coal-dust in the air. Cotton-gins are frequently set on fire by the ignition of fine particles of cotton in the air.

Improved Molding Machine.

The efficiency of American wood-working machinery, as compared with the clumsier and slower working machines of European makers, has been recognized throughout the civilized world. The first impression of a foreign artisan, upon seeing one of our planing or molding machines in operation, is likely to be that it is tearing itself to pieces, and will in a short time have to be thrown out. He can, for some time, hardly understand how an automatic machine, possessing so many devices and adjustments, can throw off chips and shavings with such a breakneck rapidity without serious injury to its mechanisn, and is surprised to learn that its durability is fully equal to the slow-going contrivance for wood cutting, esteemed as their best productions on the other side of the Atlantic. One of the American machines of this class that have won, universally, favorable recognition is the Medium Size Molding Machine illustrated on this page, which is made by J. A. Fay & Co., Cincinnati, Ohio. This machine is designed for doing all kinds of work in a general jobbing shop.

It is constructed with very heavy and substantial framing, and is capable of working moldings up to 8 inches wide, and also all kinds of sash, door and blind work. The feeding rolls are so hung, that both ends raise parallel with the stuff being worked, and so weighted from below as to secure a uniform pressure at all times on the stuff.

By lifting the weighting lever the operator can at any time withdraw the stuff before it reaches the cutter head. A very complete tool box is affixed to the roller cranes.

The upper arbor is fitted with a steel head slotted on all four sides, is of large diameter, revolves in self-oiling bearings, and the table or platen is raised or lowered by a single screw.

An adjustable outside bearing is fitted to the main arbor, which prevents vibration on heavy work.

The upper head and arbor has a lateral adjustment for accurate work on moldings.

The under head is also made of steel and slotted, and revolves between adjustable nose pieces, which can be set so as to enlarge or decrease the opening in the table.

An adjustable pressure plate is arranged over the under head, and the knives when once set can be instantly adjusted to suit different kinds of planing without stopping the machine.

The side spindles are of steel, run in self-oiling boxes, are fitted with slotted steel heads, and have vertical adjustments to suit the work being done. The outside spindle can be adjusted to varying angles.

The weighted shaving bonnet and attached pressure shoe can be instantly swung around clear of the bed, giving the operator ready access to the knives.

Full sets of springs for holding down the stuff are sent with each machine, and counter-shaft with pulleys fitted for wide belts, and the patent loose pulley forms part of the machine.

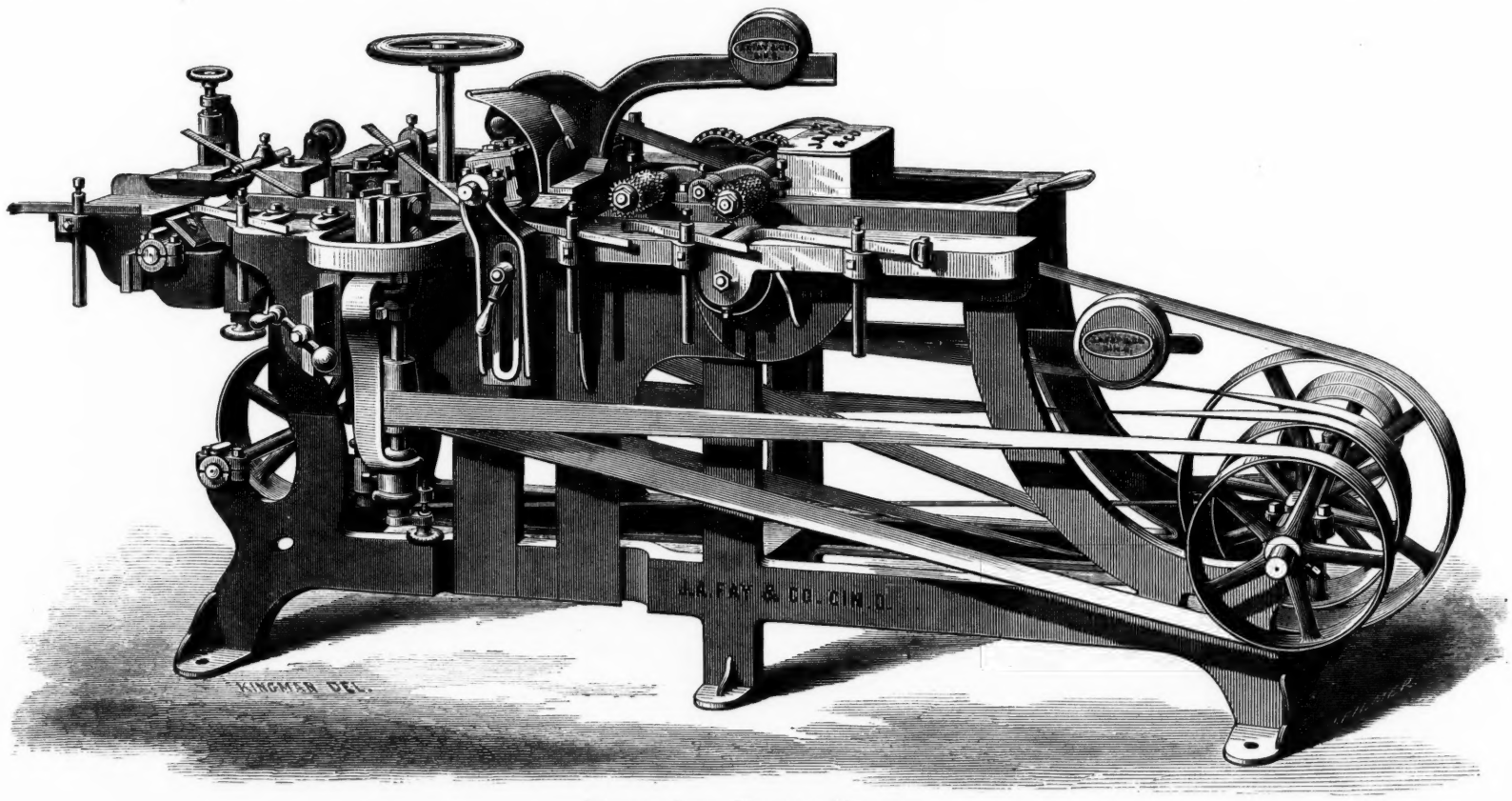
Matcher heads can be fitted to the machine for working flooring, ceiling, etc. When desired, heads and cutters for working sash, moldings, panels, blinds, doors, etc., are furnished as extra.

They are made to work either three or four sides, as customers may desire, and are most carefully and thoroughly fitted in every part.

The tight and loose pulleys are 8 inches in diameter, 4-inch face, and should make 875 revolutions per minute.

These machines are sold at the machinery depot of the Geo. Place Machinery Agency, 121 Chambers street, New York, they being sole Eastern agents.

In making envelopes by hand, a single person can produce in a day only from 2,000 to 3,000, according to shape and size. Machines are now building that are expected to make 90,000 to 100,000 a day each.



MEDIUM SIZED MOLDING MACHINE.

Engine Proportion and Construction. Disengaging Valve Motions and their Adjustment.

Editor American Machinist:

When Mr. Corliss first adopted a regular standard of style or pattern for his horizontal engine cut-off gear, somewhere about the year 1853, he fixed on a plan superior in many respects to the standard now used by him.

Then there were no pieces of the detail of valve work attached in any way to the steam cylinder, save the four small connecting rods leading from trip motion to valve-stem arms.

All of the cut-off motion was fastened to the main bed-plate, or frame at a point, nearly central with its length, and well away from the heating and expanding influences of the cylinder, and as the latch-block catches on, barely more than one-eighth of an inch, it will be readily seen that all parts have very little leeway for disarrangement from the cause mentioned.

But the old plan has been discarded, and now every part connected with valve gear is attached to the cylinder, and is, of course, subject to all the changes by temperature common to the locality. Adjust this motion when engine is cold as perfectly as any valve setting can be, then start the engine, and, after an hour's running, take a diagram from *each* end, and they will show anything but proper setting; the conditions have been changed by the simple matter of expansion of metals, so it is absolutely necessary to make a final adjustment of this motion after the engine reaches its working temperature.

The exhaust valves of a Corliss engine seldom have lap and travel enough to give compression suited or required for *high* piston speed. These builders have their reasons for so doing, of course, which I certainly shall not question.

While the Wright engine (Newburgh), and the Brown engine (Fitchburg), both have their cut-off gear entirely assembled at the *lower* part of cylinder, they are not affected like the Corliss, as one has no wrist-plate, and the other, though a plate is used, has it so far removed from heat, and so short in connections, that no trouble is experienced on this point.

The exhaust valves of a Brown engine are operated by the best method ever introduced for this purpose. They are worked by a cam which throws the valve wide open just before the beginning of the return stroke, and there the valve remains until within a short distance of the finish of the return, when it closes as suddenly as it opened, to give the required amount of compression the lingering of the valve is accomplished by a concentric spot on the cam. I have seen these engines running at very high speeds, and never saw over one pound uniform back pressure registered by the indicator.

There is one very important thing overlooked many times in adjusting and setting trip cut-off gear. This is the matter of ascertaining if the eccentric rod (whenever it is used) is the proper length. Simply because an eccentric rod grasps a wrist-plate instead of a valve-stem is no reason for failing to attend to this prime mover. When a competent engineer prepares to set a plain slide valve, he first squares the motion and fixes the length of the rod exactly; he is then ready for the final touches. The leading motion for all detachable gear worked by an eccentric must have the same attention and correction of errors.

As for steam lead, I do not believe in it beyond $\frac{1}{16}$ of an inch. A valve motion too lazy in its movement to open a valve without wire-drawing is entirely unfit for use in these days, and I am happy to say that the kind just designated as lazy are very limited.

Our American automatic valve motions are all bordering a little on the complicated order, but they are so well made that this fault is lost sight of.

WM. H. HOFFMAN,
Passaic, New Jersey.

Practical Instruction.

BY ROBERT GRIMSHAW.

Trades-unionism and piece work, while they may have many excellencies, have, between them, done away with the apprenticeship system of a generation ago—a system which, although it had then its advantages, and would be in many respects unsuited to our present age, and social institutions, bore (in spite of these disadvantages) good fruit of thorough workmen; master craftsmen skilled in routine, and equal to emergencies, or unaccustomed work; not only competent to do good work in every branch, and with all the tools of their trade, but able to repair, or make these tools, or to devise others at a pinch.

At present, a boy, or young man, wishing to learn his father's trade in his father's own shop, is hampered by the unwillingness of the union men to permit more than a certain limited number of apprentices, and by their equal unwillingness to impart any art in which the youngster could, by acquiring it, supersede, or compete with a journeyman.

Drawing an illustration from the machine shop, I may say that the piece-work system, while enabling us to compete in the markets of the world, fills the trade with specialists who are mere automatons, capable, indeed, of doing some one job faster, or running one machine better than another, but still living machines, and not expert workmen.

An improved method of technical instruction in this line would turn out expert, general workmen, capable, also, by practice, of excelling in special work.

Under the old apprenticeship system, sweeping out shops, and doing other laborer's work there (not to mention other tasks not connected with the trade) was all wasted exertion on the part of the learner, but paid the master for time and material used in teaching.

In these days the "jour" has a direct interest in *not* aiding the learner, who can only arrive at good work after a succession of cursings at his bad. After having botched a job in every conceivable and possible way, and been emphatically informed of it each time, the next time it will be likely to be right; and if the younker's patience, and the boss's material hold out, and he gets sufficiently varied practice (which now-a-days he is not at all apt to get) he may turn out a workman, a machinist instead of a machine.

But for 19 would-be learners out of 20, the chances in favor of their being struck by lightning, or sent to Congress to help cripple the national industries, are rather better.

To be deliberately taught how to square himself for a job, to choose the most economical and convenient mode of arriving at the best results; how to select his tools, and hold them, would surprise a learner in almost any one of our shops, and cause a strike among the regular workmen.

Lectures on technical subjects, telling of the nature, sources, and uses of materials, the science of heat, and the construction of the steam engine, and appurtenances, make the learner more intelligent, and more capable of taking hold of hints, when this mode of teaching is not veiled with mathematics and high science. There are institutions which are doing noble work in this line, and would do more were it not that often "*de fodder am too high for de sheep.*" There is, too, a danger lest cumbrous machinery of organization, the intense conservatism of dignified and respectable old age, egotism, jealousy, or the desire for personal preferment, limit and hamper their usefulness.

Many visitors to the Centennial remember the admirable showing of the Imperial Technical School at Moscow, and many can well certify to the almost incredible results of the system, as applied in the Massachusetts Institute of Technology at Boston. Many, also, are familiar with the workings and good effects of Cornell University (which has had the bad fortune to lose Prof. Jno. E. Sweet), the Stevens' Institute at Hoboken, and one or two other practical schools in this country. The benefits of the Franklin Institute are so undoubted, that we can only regret that they are less extended and varied.

The value in money and culture of the marvelous cluster of training schools centering in the South Kensington Museum, London, can hardly be estimated. I have visited and carefully studied the systems of the *Ecole Centrale*, the *Ecole Polytechnique*, and the *Conservatoire des Arts et Métiers*, at Paris; the *Gewerbe Akademie* and *Gewerbe Museum*, at Berlin; the *Polytechnicum*, at Dresden, and other institutions, and from them I gather the ideas of an institute capable of doing valuable work among handi-workers.

To my mind, there should be no society with one-horse machinery. Among the means of instruction there should be the following:

Monthly meetings or *conversaziones*, similar to those of the Society of Arts, of London. At these meetings a report should be presented upon recent progress in science and the arts, and those present should add their list of new and good things; that popular and useful papers on science should be read, and not tabled, as at many meetings of societies, but discussed freely. Useful popular measures should be proposed and considered; new inventions (excluding trivialties) described and illustrated by models, diagrams, megascope, lantern, and actual working. No routine business should be transacted at these *Conversaziones.*

Lectures in familiar style, ranging over the whole field of practical science. At these lectures, a synopsis should be prepared and distributed beforehand, and critisism and discussion invited. A lecture on filing, for example, should have a bench and vise, files and rasps, as well as huge models showing the shape, proportion and disposition of teeth. The lecturer should show the proper height of vise and work, best mode of holding file; explain the quality of material to be worked; best mode of attacking it in each case; nature and order of tools to be used; stroke and touch to effect best work, rough or finished; what constitutes good work, and how to detect bad; selection, care and repair of tools, and a hundred other things not taught in shops with any system, if, indeed, ever imparted. Similarly there should be lectures on forging, chipping, sawing, turning, moulding, metal-spinning, planing, and other shop operations, which should be shown and explained.

Classes in practical branches, at which actual illustration, as in the last case, should be employed as a leading feature. There should be, also, instruction in free-hand, architectural and engineering drawing and designing.

"*Quiz*" *Classes* based on the regular lectures and classes, as in our best universities; *Visits and Excursions* to leading shops and industrial regions, to observe actual work.

Competition for honor or prizes for drawing, designing, mechanical skill, etc. If the head of each machine shop were to offer a prize for the best surface-plate, or for the best job at filing a V thread on a 3-8 inch rod, or the best *cube* filed, there would be *some* good work presented, and a great many men could not compete at all.

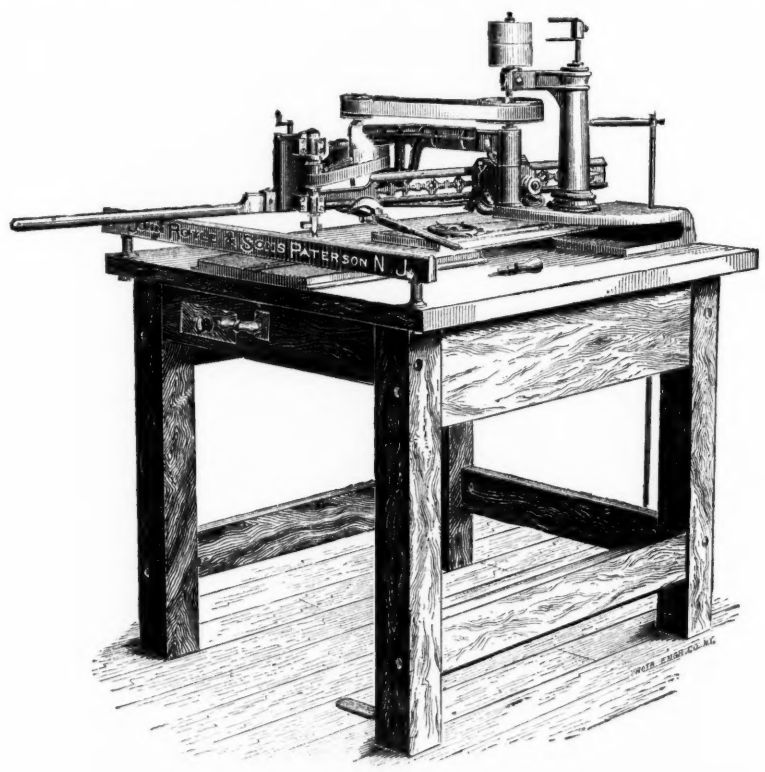


FIG. 1.—STRAIGHT LINE ROUTING MACHINE.

Blowing off Steam Boilers.

A French essay has the following on blowing off steam boilers: Those who possess externally-fired boilers, working only by day, have all observed that the fire being covered by night, and the doors closed, the pressure rises during the night, often sufficiently to open the valves. This shows that the masonry, being at a much higher temperature than the boiler which it envelops, imparts to it some of its heat. The same effect of heating the boilers is produced, to a less degree it is true, but nevertheless to some extent on the outer jacket of internally-fired boilers. It is consequently injurious to empty boilers soon after having stopped them, because after emptying, the plates would be heated by the action of the masonry. It is well to admit a current of air through the flues some hours after the stoppage of the generator, and not to empty it before the flues become cooled to a temperature below 150 degrees. When the flues are not too hot, no serious inconvenience is experienced in emptying the boiler under pressure. We do not say at high pressure, as for a boiler the pressure of which would be 5 kilogs, the temperature of the water being 152 degs., a greater quantity of steam would be generated during the process of emptying; we think that at a pressure of one kilog. the boiler could very well be emptied. In internally-fired boilers, as there is no masonry to cool in the furnace tubes, it would be well to admit the current of air intended to cool the masonry behind the boiler, as in this case the furnaces would be cooled more rapidly than the jacket. We have sometimes seen owners empty their boilers almost immediately after the fires have been extinguished, clean them with cold water as soon as they were empty, and keep up a current of water so that the workmen might work there. Boilers of small dimensions sometimes resist treatment, but in large boilers it will be seen that unequal contractions must take place, which burst the rivets.

An arrangement for water-wheels, to avoid bevel gearing, is to put two 35-inch turbines about two feet apart on one horizontal shaft; the water is admitted between them and passes outward.

We all laugh at Goldsmith's account, in the Vicar of Wakefield, of Moses going to the Fair, and it is certainly a comical picture. Moses starts off in the morning on horseback, pranked and adorned by his admiring sisters, his hat cocked with pins, his hair tied with a broad, black ribbon, wearing a coat of thunder and lightning cloth—much too short for him, a gosling green waistcoat, and having on the saddle in front a deal box wherein to stow his bargains, for, according to the family cult, Moses is great at a bargain. In the evening Moses is seen returning, sweating under the weight of his box, without horse, and without money, and when the family gather round him to inspect his purchases, he produces "a gross of green spectacles!" Yes, that was all; he had sold his horse, had fallen among sharpers, and had spent all his money, and all he had to show for it was a gross of green spectacles—and copper-bowed ones at that. Moses was well berated for his folly, but was it folly after all? Don't we all go to a fair to get a pair of spectacles, and is it not the most desirable thing to carry away? This is in fact, the purpose of fairs, to give us spectacles, wherewith we may see the world's advance, may see how our own art or manufacture is carried on by other men, in other countries, may see, in fact, how to improve our own work, and enable other men to see our work, and to buy it, having proved that it is good. Let us all go to our fairs with the *intention* of getting spectacles.—*Furniture Trade Journal.*

Incrustation in Boilers.

Analyses of a great variety of incrustations show that carbonate and sulphate of lime form the larger part of all ordinary scale, that from carbonate being soft and granular, and that from sulphate hard and crystalline. Organic substances in connection with carbonate of lime will also make a hard and troublesome scale. The presence of scale, or sediment, in a boiler results in loss of fuel, burning and cracking of the boiler, predisposes to explosion, and leads to extensive repairs. It is estimated that the presence of one-sixteenth inch of scale causes a loss of 13 per cent. of fuel; one-quarter inch, 38 per cent., and one-half inch, 6 per cent. The Railway Master Mechanics' Association of the United States, estimates that the loss of fuel, extra repairs, etc., due to incrustation, amount to an average of $750 per annum for every locomotive in the Middle and Western States, and it must be nearly the same for the same power in stationary boilers. It is absolutely essential to the successful use of any boiler, except in pure water, that it is accessible for the removal of scale, for though a rapid circulation of water will delay the deposit, and certain chemicals introduced into the water will lessen it, yet the only certain cure is periodical inspection and mechanical cleaning.

A letter from Carthagena, U.S. of Columbia, says: "American prints are in good demand, so are hardware, rice, and corn machines. The rice machines, however, have not given good satisfaction. American machinery of almost every description that is used in tropical climates would, if properly introduced, bring good prices here. The American Consul at this port informs me that he will be glad to give every information in his power, toward extending the trade between our country and this port.

A new machine of Mr. Edison's invention, designed to turn power into electricity, is said to give back 92 per cent. of the power expended in the form of electricity. All these results point to a speedy solution of the problem of electric lighting, if it can be solved.

The Springfield, Mass., gas company decided to extend the Holly steam-heating service in that city, the experiments last winter giving satisfaction. Only 4 out of 58 stockholders opposed the project, and they did so on the ground that it was not legitimate business for the gas company.

Discussion on Steam Economy.

Mr. Editor:

Our mutual friend, Mr. Church, sits right down on those innocent questions of mine—conundrums he calls them—with an emphasis truly discouraging; guesses one or two of them, just to show how easily he could dispose of them all, and winds up in a way suggestive of the interpretation that he don't pin much faith to such things. Can't resist the temptation to fire off a first-rate one at me, though. Mr. C. ought to allow one to disagree with him, occasionally, without putting an ugly construction to it. Swapping ideas is the name he gives it, but what's the good in swapping ideas if they are all alike? About that internal condensation: I never thought of denying the 20-lb. neighborhood doing just as good duty as anything else—say 5 lbs. or 50 lbs., for instance—in the case to which he applied it, but the application has no necessary connection with the statement.

The whole subject of cylinder condensation is usually rather *foggy*, and more light on the matter would seem to be a good thing. To be told that, under "ordinary conditions," "about 20 lbs.," is anywhere from 10 lbs. to 30 lbs., if it don't teach us anything else, will teach us to let it alone so far as basing any calculations whatever upon the theory. It would take too much figuring for the amount of satisfaction obtained.

Concerning that little conundrum of Mr. C.'s—superheating by leaky valves—before wrestling with it, let me say, by way of swapping ideas, I haven't the slightest "theory" of valves, under ordinary conditions, leaking to any such extent as he believes them to, and what "practice" I have is more against the probabilities of such leakage than the theory, or, rather, than the lack of a theory. Were I consulting with the owner of a steam engine, the valves of which leaked to the extent he intimates, with no obvious remedy, I would seriously advise said owner to lose no time in getting it off his premises. The probabilities are he could sell a couple of boilers and buy a *cut-off* engine with the proceeds. My idea of leaky valves is, they are wonderfully overrated. Unquestionably, they can't be made to work tight—probably not tight enough, ordinarily, for nice scientific experiments—but it is at least an open question if any very remarkable results would follow were absolute perfection attained in their manufacture and use. I am free to admit I used to think differently from this, and it cost some money, and more time, to effect a change in base of opinion on the subject.

I did imagine, only this morning, I had struck a bad case of leaky valves—something worth investigating. Passing within 20 feet of the open end of a 3″ exhaust, there was unmistakable evidence of a serious leak into it from somewhere. Went to the engine-room and asked Joe what the matter was, and found he had opened a cylinder cock five minutes before, and hadn't closed it. Now, this cylinder cock (to make a bull of it) was a ¼″ globe valve, just about half open, and connected to exhaust pipe with four elbows; yet it was "booming" through 40 feet of 3″ pipe in a way that suggested the speedy loss of all the steam in the boiler. Closing this valve took away all objection to the sound of that exhaust and spoiled a subject.

Another case in mind is an engine having a slide valve relieved by a packing ring on the back, and working against the cover. The cavity under the ring is connected with exhaust by a tortuous hole scarcely more than ⅛″ in diameter. Occasionally, this ring gets "stuck," and, when this occurs, you can hear that valve blow all over the engine-room, and it isn't a small one at that. Now, all the fuss, in this instance, is made by what steam passes through an ⅛″ hole. It is undoubtedly true that considerable steam may be coasted through a hole of that size, but it is equally true that a small part of the disturbance noticed could at once be detected by the engineer. Mr. C.'s suggestion that blocking the engine in one position is insufficient to test the condition of the valves is right, but why say *one* position? Why not swing right round the circle? There are as many points in the circumference as there are holes in a skimmer. You couldn't get a "corner" on them if you tried. I haven't the slightest prejudice against balanced or relieved valves. On the contrary, there don't seem to be any good reason for dragging along 3 or 4 tons pressure when it can so easily be avoided. I am also heretic enough to believe in flat wearing surfaces, but it is well enough to remember that some of the best builders in the country show, by their practice, that they think differently, and that one of them at least, years ago, discarded the flat slide for the circular. While believing in the utility of relieving the slide-valve of so much of the pressure as it is practicable to remove, considerable observation leads to the belief that properly constructed unbalanced valves of this class will, and have, run for years under ordinary pressures, and, with reasonable care, without scoring or cutting on either their steam or exhaust edges, but that, for obvious reasons, such valves, as usually constructed, do score badly at the ends of the exhaust cavity and in the direction of their travel.

But to get to the superheating question. What I really said was: "If leaky steam valves were to draw such an amount of steam into the cylinder, would it not, by superheat, *tend* to make the water account of the indicator and boiler supply more nearly balance?" (referring to the disparity in the two accounts). There ought to have been a legend attached to that query. It might have read something like this: N. B.—This query has reference to the generally accepted fact that the greater the quantity of steam used in the cylinder, other conditions being equal, the more nearly are these two accounts found to agree—as, notably, in a cylinder having a full stroke valve, and any valve which leaks to the extent of raising the terminal pressure 10 lbs. is a full stroke valve, no matter what it is called. But this explanation wasn't tacked on, and it won't do to dodge the text just as it stands. I have to get a goodly proportion of the little knowledge I have of the properties, and even the behavior, of steam from the investigations of others, and friend Church won't ask for my authority for saying that wire-drawn steam contains an excess of heat. It is immaterial, so far as this excess is concerned, whether the throttling is done by some special device, or by the distribution valves. Such "leaks" as Mr. C. refers to are simply throttling, and result in supplying the cylinder with wire-drawn steam, containing an excess of heat which *tends* to prevent condensation and re-evaporation.

F. F. HEMENWAY,
Troy, N. Y.

New Routing Machines.

Before entering into a description of the routing machine illustrated on opposite page, it will be, no doubt, proper to explain the meaning of the name routing. In the process of engraving wood or metal, after the outlines have been cut, it becomes necessary to cut away the material where the imprint is to appear white, in order that the paper may not touch the wood. This operation is called routing. If it were done by hand it would involve a large amount of work, thereby increasing the danger of spoiling the fine lines, and necessarily adding to the cost of the engraving. Machines are, therefore, designed to do this work. The straight lines or shading of wood cuts are also done by the routing machine, which does it cheaper and better than by hand. In reference to material we would say, referring to Fig. 1, that with this machine, fine or coarse work, zinc, type metal, electrotypes, stereotypes, hard or soft wood, may be routed equally well by simply inserting a suitable cutter. Straight and parallel lines may be cut with a display of little or no skill on the part of the operator.

The surface of the tables is entirely clear. In routing large blocks, which often embrace an area of five or six feet, this will be found an important feature.

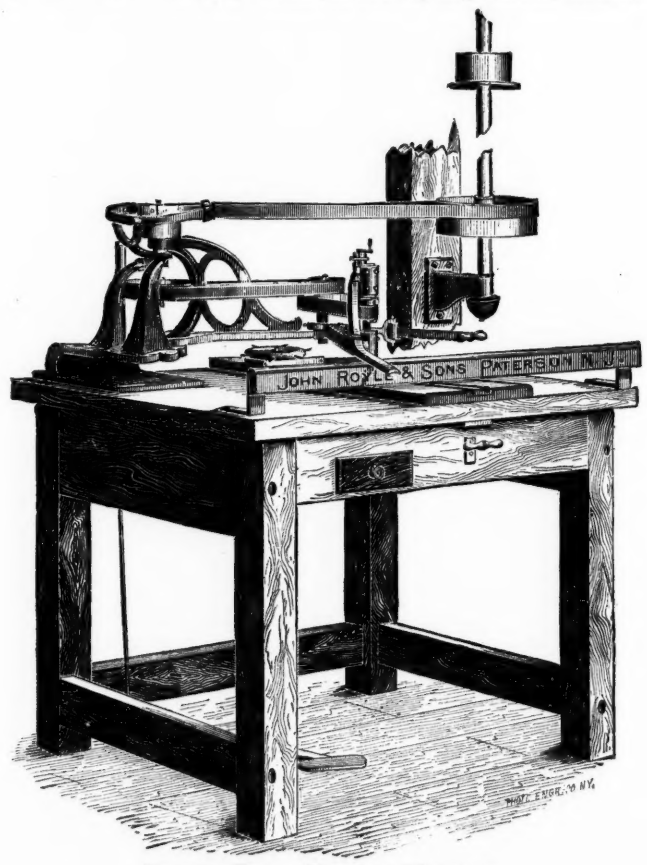


FIG. 2.—PLAIN ROUTING MACHINE.

The bearings are made self-oiling by means of an oil box inserted in the box itself, which is packed with wool or any other suitable material. This device is new, and effectually prevents the oil from being thrown over the work.

The machine is provided with a raised iron bed-plate, in which is arranged an ingenious "dog" or gripping device for holding the block to be routed. By this device all classes of work may be securely fastened with the best facility and dispatch.

The machine may be instantly started or stopped by the foot of the operator, thereby allowing free use of the hands to guide the cutter, which is done by means of a handle which is worked by the left hand, and a small lever for the right. By the aid of this handle and lever the cutter can be moved in all directions. It is also fitted with a slide-rest for fine vertical adjustment; is made secure at any point by tightening a small screw, and may be quickly adjusted to suit the height of the work to be routed without stopping the machine.

Attached to the lower end of the routing spindle, immediately above the cutter, are small fan blades, which, from the high velocity of the spindle—10,000 to 12,000 revolutions per minute—produce a current of air sufficiently strong to effectually remove dust and chips from the work.

On the cutter bar of the machine is the extensible handle, previously mentioned, by which the operator can, at will, without constraint, be enabled to reach with the cutter distant parts of the block upon which he is at work.

The bar of the machine is worked between small pulleys, or rollers, so arranged as to secure firmness and reduce friction. Sliding friction is almost entirely overcome.

In order that the machine may be run at a high speed, the bearings are made with great care, and all pulleys carefully balanced. The pulleys, as well as the bearings, are also so made as to prevent the oil from being thrown by centrifugal force.

The counter shaft is not attached to the machine, thereby avoiding the tremor usually produced by the main driving belt when the upright shaft is attached to the machine.

By the use of very fine cutters the most delicate work may be routed. The spindles are of steel, and all the work is made in the most thorough manner.

Fig. 2 represents a plain routing machine, which possesses all the advantages of Fig. 1, excepting that straight lines cannot be cut. It is also a cheaper machine. These machines are manufactured by John Royle & Sons, Machinists, 184 and 186 Water Street, Paterson, N. J., who will furnish all necessary information upon application.

Labor Strikes.

St. Louis is bothered with the striking fever. The stove moulders struck for 15% increase on piece work, which stopped most of the stove foundries in the city. The coopers' strike was an extensive one. The cigarmakers went on strike, and every Chinaman in the city working at trade (eight in all) have joined the strikers—"Allee same as 'Melican man."

The coopers' strike at Syracuse, N. Y., is virtually ended by a compromise in most of the shops, favorable to the workmen.

The coopers' strike in St. Louis still continues, and millers are bothered to get flour barrels. The latter have expressed their willingness to pay for barrels a price that will cover all the advance asked for by the coopers, but the "bosses" are stubborn and seem determined to keep the workmen down to the old rate of pay.

The Indianapolis car drivers have struck for stools to sit on.

The threat of ejection from their dwellings made by the owners against the strikers at the Springhill, N. S., mines, has been carried out, and the men with their families have quietly moved away.

Four hundred coopers struck in Chicago, Sept. 9, for an advance of five cents on a tierce. It is believed that most of the shops will accede to their demand.

Truckmen and freight handlers in the Michigan & Southern R.R. warehouses, Chicago, struck for an advance of wages from $1.05 to $1.14 a day. They claim they have been required to work 13 hours, or more, daily.

The striking Fall River spinners have made another appeal to the workingmen of America for aid.

200 members of the Chicago Dock Laborers' Union struck for 25 cents an hour. They now receive 20 cents.

Furnacemen of Youngstown, O., struck for an advance of 15 to 20 cents a day. Five furnaces were kept idle by the strikers.

Laboring men employed in the American Iron Works, Pittsburgh, decided to strike for an advance from $1. to $1.25 a day.

The coal miners in the Cumberland region struck for an advance to 50 cents a ton. Over 2,000 miners and 500 laborers joined in the strike. The demand was complied with.

General laborers on I. C. R. R. who struck in Chicago for an advance of wages, have received it. The advance is from $1.10 to $1.25 a day.

Fort Wayne, Ind., lacks water for fire protection, and is looking for a new supply.

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☞ *We invite correspondence from practical machinists, engineers, inventors, draughtsmen, and all those specially interested in the occupations we represent, on subjects pertaining to machinery.*

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Special.

We wish to make the following facts fully understood by our readers:

1st. That nobody has ever paid the publishers of the AMERICAN MACHINIST one cent for anything inserted in its reading columns, either for illustrated descriptions of machinery and tools, contributed articles, editorials, manufacturing notes, book reviews or reviews of shop supplies.

2d. That we never will publish any notice for pay, either direct or indirect, except in our advertising columns.

3d. That no party interested in making or selling machinery, engines and boilers, or in their manipulation has, or ever has had any pecuniary interest in the AMERICAN MACHINIST.

Motive Powers for Machinery.

In considering the various kinds of motive power employed to drive machinery, they may properly be divided into two distinct classes: those that require the generation and application of heat (combustion), and those that do not. The oldest and simplest motive powers in the world are those of wind and descending water. Where a constant and reliable water supply can be depended upon, having sufficient volume and descent to drive mills and factories, no other power can compete with it. It is virtually costless, as it only necessitates keeping a dam in good condition, and often even this is not required. The expense of wear-and-tear upon motive machinery is, with the best turbine wheels, a mere bagatelle. According to the last complete United States census there were more water wheels in use throughout this country than steam engines, and it is unlikely that the proportion has been reversed within the last ten years. The amount of available water power now unused would drive all the machinery ever required; but there are valid reasons why a considerable portion of this power is allowed to go to waste. Water power, not being movable like steam power, must be used wherever it can be procured, which is often in very inconvenient localities for manufacturing operations. Then the power derived from water is often irregular and unreliable. A dry season may come in the busiest time, and water power fail. Wind is successfully employed in pumping water, and in many minor manufacturing enterprises, but, besides being inconstant, the capacity of machinery adapted to wind power is too small to allow of its taking high rank among the motive forces; moreover, the tendency of wind to exert too violent a power at times, to the detriment of propelling mechanism, operates as a check to its extensive use. Animal power for driving light machinery, where not in constant operation, will always be used to a wide extent, but if it is required to run the machinery steadily, from month to month, some other power is better and more economical.

Animal power requires the consumption of food as a fuel, and is not adapted to moving heavy mechanism. Since Ericsson first brought out the hot air engine this form of power has had many advocates, but has made slow progress. A very few of the many hot air engines invented have been successful for limited power, but there are mechanical difficulties in the way of their general adoption for driving machinery.

To dispense with a boiler and an engineer are the greatest advantages accomplished by hot air power. Recently the gas engine has been brought prominently forward in this country, it having been extensively adopted in Europe, after much improvement and exhaustive trial. It possesses the same features that make the hot air engine desirable, viz: dispensing with boiler and engineer. Besides these advantages it works without coal, wood, or ashes, and when stopped consumes nothing whatever, thereby requiring no expense except when running. In point of economy it has, in several instances that have come to our knowledge, given very gratifying results.

Machine shops have been run with gas engines at one-half the expense necessitated in running them with steam engines of equal power. The expense, of course, depends upon the charges for gas, which, in many places, has been reduced since last spring. The gas engine, like many other motors, seems to be confined in its successful employment to small powers, but with the results now being attained, it is likely to crowd out steam in many places where the latter is used to drive small shops, elevators, printing presses, and in doing similar kinds of work. Where gas is not used (as in country places) the gas engine, of course, does not come into competition.

Next to gas, the motive power that is now making the most rapid progress for driving machinery is compressed air. This, however, is not a primary power, as the force required to compress the air ready for use must be obtained from outside sources. Its greatest advantage lies in its applicability in situations where heat, ashes, or steam are not to be tolerated. It is well adapted to driving rock drills in mines, propelling street cars, and many other like purposes. Recent experiments have developed some new and valuable facts in the use of compressed air, which will soon be laid before our readers, by one who bore a prominent part in the experiments resulting in the discoveries.

Electricity has been often tried as a motive power for machinery, but, so far as we have any knowledge, it never has been permanently successful beyond two dog power, and it is doubtful if it can be made economical at that capacity.

Ericsson has perfected an engine that makes steam by solar heat, which may come into extensive use, especially in tropical countries where the sun's rays are hottest. This is the only heat engine that will run without fuel. With the exception of wind and water, the solar engine is the only motive power made available without the expenditure of some substance for fuel. Animals consume food, the electrical battery chemicals, and heat engines consume coal, gas, oil, wood, or other substances of a combustible nature.

After taking a careful survey of the whole field, the conclusion must force itself upon any thoughtful mind, that for driving all descriptions of machinery, requiring either large or small power in any locality, or changing from one locality to another, upon land or at sea, no motor has yet been discovered that can take the place of the steam engine.

Efficiency of our Expensive Naval Academy.

The following press dispatch throws some light upon the boasted efficiency of our United States Naval Academy at Annapolis, Maryland:

WASHINGTON, Sept. 6.—Richard Gatewood was graduated No, 1, in the class of Cadet Engineers, at the Naval Academy, last June, and F. T. Bowles, No. 3. The former is from Virginia, and the latter from Massachusetts. They made application to the department that they be allowed to attend the Royal Naval College, at Greenwich, in order to study naval engineering, architecture, etc. That college is allowed to take a number of private students, including two from each foreign nation. The request of Gatewood and Bowles went from the Navy Department through the Department of State to our Minister at England. The request of the young men to be admitted at Greenwich has been granted without their undergoing the usual examination, their certificate of graduation at the Naval Academy being considered sufficient by the English Government. They will enter at the October term.

Could any further evidence be required, by any patriotic citizen of America, to carry conviction of puerility in the administration of our Naval Academy, upon which millions of the people's money have been freely lavished? The publication of the above dispatch by the press, throughout this country, should stir up a feeling of the deepest humiliation in the breast of every man in any way connected with the management of the the United States Naval Academy, at Annapolis—an institution lauded by all government dependents, who profit by its patronage as "the best naval school in the world." One of the choicest products of that institution is the Cadet Engineer, who is placed in charge of the steam machinery of our men-of-war. Here we have two graduates of the "best naval school," conscious of their deficiency in knowledge of "naval engineering, architecture, etc.," ambitious enough to enter a Royal Naval College, to acquire an education in the profession they are to follow. Their request, after going through the usual course of red tape, is granted, and, the English Naval Authorities, not wishing to subject the young men to any exposure of ignorance, graciously allow them to enter "without their undergoing the usual examination, their certificate of graduation at the Naval Academy being considered sufficient!"

Here is a subject calling loudly for reform.

We hope some enterprising member of Congress will, at the next session, move for an investigation into the conduct of the Naval Academy, and persistently follow it up until the whole measure of corruption and fossilized mismanagement is exposed, and the abuses corrected.

The American Institute Fair, which will extend this year from the 17th of September to some time in November, promises to be more interesting and instructive than usual. Entries of machinery are sufficient to insure a good display in this department. An expert trial of a leading steam engine and a patent boiler will add interest to the exhibition. Particulars of this trial may be looked for in our columns at the proper time.

In several issues of our paper, viz.: June 28th, Aug. 2d, 9th, and 16th, respectively, there have appeared answers differing from one another in regard to the amount of water contained in a cubic foot of steam at 10 pounds pressure, and 80 pounds pressure, respectively. There is large room for discussion upon these and similar questions, and in order that the different views may come out we desire particularly that, when our readers do not fully agree with us in our answers to questions to drop us a line, and so make our labors mutually beneficial. Our columns of Questions and Answers are one of the most important and instructive points in connection with our paper. We are glad to see a more inquisitive disposition on the part of our readers, and we have a number of unanswered communications in hand all the time, it being impossible to answer them all directly. Those who send communications to us will oblige by giving their address in full, in addition to any fictitious name, not for publication, however, but as a mark of good faith.

We are always glad to hear from our friends on any new questions that will direct the minds of the practical workmen towards investigation, as they will in all probability take still further steps towards their advancement.

Notable Patented Inventions.

The Official *Gazette* of the U. S. Patent Office affords a curious and interesting study. The issue for the week ending September 2d, describes 280 new patents granted upon that date, and 11 reissues. The invention of car couplings has not been suffered to flag, for we notice four of them—about the regular average. In the copy referred to only one churn was patented, September 2d, and it required two inventors to put in the claims upon that. This shows a sorry decline in the churn business. Three washing machines, and three farm gates make their appearance in the list, proving that inventors are determined to reap the lucrative rewards in store for well directed efforts in this needed direction.

An enterprising Texan, hailing from Tiger Hill, figures as the patentee of one of these washing machines. Considering the admiration in which a "biled shirt" is held upon

the frontiers of Texas, it is to be hoped the machine will come into extensive local use.

A Michigan genius is made happy by securing a patent on a reversible wash-board. The advantages of this valuable invention are obvious. When the laundress (or Chinaman) is tired of rubbing on one side, it is only necessary to loosen a screw or hook, turn over the corrugated face, fasten it upon the other side, and make a fresh start. Thus is labor varied and its monotony broken. Only one clothes' drying rack makes its appearance in the last weekly collection of master-pieces of talent and energy. Its inventor hails from the great North Woods of the Empire State.

An architectural genius has patented a brick—not one of the kind often carried in a hat, but a simon-pure clay brick, with a groove in one side into which the mortar is squeezed, holding it in place. Four cool, calculating chaps have each invented a refrigerator. A (supposed) mechanical engineer comes to the front with a new rotary engine, the sectional view of which looks like a coarse spider web. Any issue of the *Official Gazette* would be deficient without at least one new rotary engine.

A Minnesota man secures a patent on a door-latch, opened by pressing a spring. It may be very useful to politicians about this season, who returning home late from a caucus, filled with ——— enthusiasm, find a latch key inconvenient. Only two combination tools graced the pages of the *Gazette*, September 2. We had thought there must be a falling off of original efforts in this line, not being solicited by an itinerant vender of combination tools for two or three weeks, and this record proves it. Perhaps the cool weather will stimulate inventive genius to bring out more novelties of this class. One of these new tools is a combined hammer and corkscrew, probably intended for bibulous workmen.

A machinists' tool manufacturer, one of our patrons, becoming of an amusing turn of mind, comes out with a patent cribbage box. May he long keep pegging away.

None will be surprised to observe that many of the new inventions are accredited to localities famous for the particular class of business each is designed to aid. Thus we find the patentee of a new shirt hails from Troy, N.Y.; of a sleigh bell from Easthampton, Conn.; of a glass mold from Pittsburgh; of a new bung for lager beer kegs, from Milwaukee; of a pretzel machine from Shimerville, East Pennsylvania, and of a sausage machine from Cincinnati.

Machine Shop Wages.

Fred'k. B. Miles, Machine Tool Works, Philadelphia, pays machinists $1.50 to $2.50 a day, with an average to good workmen of $2; blacksmiths, $2, average; pattern-makers, $1.50 to $2.50; moulders, $2, average; helpers, $1.50.

D. Saunders' Sons, Yonkers, N. Y., pay machinists $2 to $3.50 a day, an average being $2.50; blacksmiths, $2.50; helpers, $1.50.

Robt. Wetherill & Co., Chester, Pa., pay machinists $2.25 to $3 a day; boiler makers, $2; blacksmiths, $2.75; moulders, $2.25. pattern-makers, $2 25; yard laborers, $1.25.

John Wood, Jr. & Co., Conshohocken, Pa., pay machinists from $9 to $16 a week; boiler makers, $10 to $15; moulders, $8 to $15; pattern-makers, $10 to $14.

Sawtelle & Judd, Hartford, Conn., pay machinists $2.25 to $3.50 a day, averaging $2.75; helpers, $1.00 to $1.25; blacksmiths, $2.50. Business good and prospects bright.

The Morse Twist Drill & Machine Co., New Bedford, Mass., pay machinists $2.25 to $3.25 a day, averaging $2.85; blacksmiths, $3.00 to $3 50; helpers, $1 75; forgers, $3.50.

Kendall & Roberts, Cambridgeport, Mass., pay machinists $1.75 to $2.25 a day, averaging $2.00; boilermakers, $2.50; helpers, $1.50 to $1.75; patternmakers, $2.25 to $2.50; blacksmiths, $2.25.

A machinist writes us from Lewiston, Me.: "Following are the rates of wages paid by the Lewiston Machine Co.: Machinists receive $1 to $1.35 a day; two or three receive $1.75; apprentices receive 40c. to start, and, if pretty smart, receive 75c. second year. Seventy hands in shop and forty apprentices in that number. Moulders receive $1 to $1.50; two or three receive $1.80. Blacksmiths receive $1.25 to $1.40; helpers, 75c. to 90c.; carpenters, $1 40; yard hands, 75c. to 90c. Sixty-two and a half hours per week."

Wilbraham Bros., Philadelphia, pay machinists $12 to $15 per week; foundrymen, $12 to $14; blacksmiths and pattern makers, $12 to $13. These rates are for the average grades of workmen. We are pleased to note that this firm are doing their part to revive the apprentice system, which notably coincides with the details outlined, editorially, in our issue of Sept. 13th. The three brothers Wilbraham are themselves practical machinists of the good old school, and take a limited number of boys as apprentices, receiving none older or younger than sixteen years of age, and none for less than four nor more than five years' time, as they do not consider three years long enough to make a thorough machinist out of even the best materials, and prefer to have each term of apprenticeship close at twenty-one years of age. The brothers give their own sons five years' apprenticeship, their aim being that every apprentice shall have the benefit of familiarity with every branch of work done in the shop. While they will not receive any except for a full term, they do not seek to bind the boys. Occasionally one runs away, but such cases are rare, and are considered a good riddance when they do occur, as a boy who hasn't wit enough to appreciate the life-long advantages that a thorough knowledge of his trade will confer, hasn't wit enough to make a machinist.

Opinions of Contemporaries.

From Bridgeport (Conn.) Daily Standard.

The AMERICAN MACHINIST is one of the very best journals published in the interest of machinists, engineers, founders, &c., &c., and the current number contains matter of especial importance to readers in all of those departments of industry, enterprise and invention. Its engravings are excellent and its editorial matter well considered, judicious and up with the times. An able article in the number for August 23, on "Kid Glove Naval Engineers," handles one branch of our naval service at Annapolis, Md., without gloves, kid or any other kind, and calls attention to abuses which should be remedied at once. Published at 96 Fulton street, N. Y., and for sale everywhere.

From Lynn (Mass.) Semi-Weekly Reporter.

THE AMERICAN MACHINIST.—This is the title of a sixteen page weekly paper, published in the interests of machinists, boilermakers, blacksmiths, founders, etc. THE MACHINIST has recently been changed from monthly to a weekly issue, the demand for the paper making such a step necessary. Besides containing articles of interest to those enumerated above, it also has editorials upon subjects of vital interest to the people of this country. On our first page, to-day will be found an article taken from this paper which shows up, in its true light, one of the evils with which this government is teeming. THE MACHINIST is published at 96 Fulton street, New York.

(From the Hudson (N. Y.) Daily Republican.)

AMERICAN MACHINIST.—We take pleasure in calling attention to this valuable publication, issued by the American Machinist Publishing Co., at No. 96 Fulton street, New York city, at $3 per annum. The last number contains an illustration and description of the double cylinder steam fire engine manufactured by the Clapp & Jones Mfg. Company of this city.

(From the Millstone, Indianapolis, Ind.)

One of our most valued exchanges and a really valuable journal, the AMERICAN MACHINIST, is now issued weekly instead of monthly, as heretofore. The paper is a credit to its managers, useful to its readers, and should be in the hands of every machinist and others interested in that branch of industry, or, in fact, any and all engaged in the handling and working of machinery generally.

(From Vox Populi, Lowell, Mass.)

We have received the AMERICAN MACHINIST, which is a practical mechanical journal, of great value to the artisan and machinist. It is published weekly, at $3 per annum, and is a very readable paper for any one of mechanical tastes.

From Leffel's Illustrated and Mechanical News.

AMERICAN MACHINIST.—We note with pleasure the change of this journal from a monthly to a weekly publication, at $3 per annum. Published at 96 Fulton St., New York.

LITERARY NOTES.

ENGINEERS' AND MECHANICS' POCKET-BOOK, containing weights and measures, rules of Arithmetic, weights of materials, latitude and longitude, cables and anchors, specific gravities, square cube, and roots, etc. Mensuration of surfaces and solids, trigonometry, mechanics, friction, hydrostatics, hydraulics and hydrodynamics, dynamics, gravitation, animal strength, windmills, strength of materials, limes, mortars, cements, etc. Wheels, heat, water, gunnery, sewers, combustion, steam, and the steam engine, construction of vessels, miscellaneous illustrations, dimensions of steamers, mills, etc. Orthography of technical words, terms, etc. Thirty-fifth edition, revised and enlarged, by Charles H. Haswell, Civil, Marine, and Mechanical Engineer, Member of the Am. S'y of Civil Engrs., of New York Academy of Sciences, of the Institution of Naval Architects, England, Corresponding Member of the Am. Institute of Architects, and of the Boston Society of Civil Engrs., etc.; 671 pp.; 12 mo.; morocco tucks. Price $3. Harper & Bros., Franklin Square, New York.

The above-titled book has been considerably enlarged since the first edition, which consisted of 284 pages, and was submitted to he engineers and mechanics of the United States by one of their number in 1843, who designed it for a convenient reference to rules, results, and tables used in engineering. From that time it has taken the place of a standard work of reference, becoming more extensively used every year, until it has now reached its thirty-fifth edition. The book is one that may be useful to any man in business, and to review it fully would be to rewrite it. Many of the tables contained in this work were compiled from extensive experiments and investigations, thereby entailing much labor and expense. The department on steam engines and their proportions, comes nearer to our American practice than any of the tables contained in the English works, and though differing from some other authors, will be found reliable. To the young engineer and mechanic it is invaluable. It will teach him how to keep a journal of recorded data, which is essentially necessary to any profession or practice. The book has been thoroughly revised and enlarged, and the long string of errata, which appears in most pocket books, has been entirely dropped, which implies that as the work is now offered it is freer from mistakes than ever before. Hardly a subject connected with engineering and mechanics, reference to which may not be found in this work.

Business Specials.

Thirty cents a line for each insertion under this head.

The Huntoon Steam Governor Co., of Lawrence, Mass., warrant a direct saving in steam of from 10 to 20 per cent. over any other Governor known; while for quick and accurate regulation, great durability and lasting economy in use, they guarantee results never before attained by any other. See advertisement.

Brown & Sharpe M'f'g Co., Providence, R. I., keep in stock at reduced prices Patent Cutters for the teeth of gears which can be sharpened by grinding without changing their form. All wheels of same pitch cut with them will run together correctly. Send for new catalogue.

National Steam Pump, simple, reliable and durable. Send for illustrated catalogue with reduced price list. W. E. Kelly, New Brunswick, N. J.

Castings, Gear Wheels and other parts of models, at lower rates than can be made by hand. Tallman & McFadden, 607 Market St., Philadelphia.

Questions and Answers.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly and according to common sense methods.

(1) G. J. G., Baraboo, Wis., writes: In your answer to my question in the AMERICAN MACHINIST of June 28th, answer 5, question 2.—Which contains the most water, one cubic foot of steam at 80 lbs. pressure, or one cubic foot at 10 lbs. pressure? You say, one cubic foot at 10 lbs. pressure. According to my rule, one cubic foot of steam at 80 lbs. pressure contains 5.574+ cubic inches of water, while one cubic foot at 10 lbs. presure contains but 1.6554+ cubic inches of water. Another point I claim on my side is, that one cubic foot of steam at 80 lbs. pressure will expand into nearly 8 cubic feet of steam at 10 lbs. pressure. Now, where does the water come from in each of these cubic feet of steam at 10 lbs. pressure, that they each exceed the cubic foot of steam, at 80 lbs. pressure, in water that they were produced from? I notice that W. G. of New Orleans, La., in your issue of Aug. 9d, takes my side of the question, but our figures do not agree. Still another in your paper of Aug. 9th. In your answer to "Economy," you say that one cubic inch of water converted into steam at 25 lbs. pressure produces 1044 cubic inches of steam, and the same amount of water converted into steam at 40 lbs. pressure did not produce but 679 cubic inches of steam. This agrees with my rule. If I have made any mistakes please to point them out. This question was brought up in our shop. You, of course, know from this which side I have taken. A. The answer given to your question in our issue of June 28th was so given, owing to a little misunderstanding of the question. Steam at 10 lbs. pressure is called wet steam, while steam at 80 lbs. pressure is called dry steam, notwithstanding it contains the most water, as the air on a very dry hot day, hence our answer. We have taken the trouble to put the same question to several of the old practical mechanical engineers in this city, and two of them claimed that the cubic foot of steam at 10 lbs. pressure contained the most water, while one other said that it was a complicated question and did not attempt to answer it. We have had several communications on the same question, all differing from each other more or less. The answer can only be approximate as nearly all the steam tables differ from each other. W. G, of New Orleans, La., likewise yourself, have, in our judgement, arrived near enough to the correct answer for all practical purposes.

(2) W. H. D. Branford, Conn., writes: Can you inform me through the AMERICAN MACHINIST how emery wheels are made? I made one of No. 90 emery, mixed with glue, which works well; also one of No. 45 emery, which will not work, but will crumble when I hold an iron to it. They are 4 in. in diameter, and ½ in. thick. I have a mold for pressing them in. A. Glue is a very bad cohesive material for emery wheels, particularly where there is any dampness in the atmosphere, as the wheels will soon begin to crumble, and are always liable to burst. We would recommend that instead of glue you use the following proportions, viz.: Emery of the required coarseness, 3 or 4 parts; shellac 1 part. This mixture, melted, incorporated and molded under pressure will resist moisture. To give the formulas used by the different manufacturers would be impossible, and we consider it much cheaper to buy a good quality of emery wheels than it is to make them.

(3) A. M. D., New Haven, Conn., writes: Is it not a correct way to estimate the amount of power that it takes to drive a machine, by taking a cord or rope and fastening it to one of the arms of the driving pulley and bringing the other end over on the outside, and then hanging weights on the lower end of the cord until the machine moves at its usual speed? I understand that it is easy enough to calculate the power of a belt, but there are not many cases where a machine takes the full power of the belt, and there ought not to be any. A. Your ideas are quite right, and in order to ascertain the power required to drive your lathe we would recommend that you take a good stout cord, not too coarse, fasten one end to the edge of the tight pulley upon the counter shaft, by means of a small clamp, then wind up the cord upon the face until nearly covered; place the belt upon the covers of equal diameter, attach enough weight to the cord to drive the lathe up to speed; place a stick near the cord upon which to mark gauge points, and observe at what point the lathe attains the required speed and mark it. The pulley being a lever of the first order, whose arms are equal levers, therefore the weight attached to the cord is equal to that required to raise the same amount. Observe the time in seconds that it takes for the weight to pass through the space from the point mentioned (on the stick) to the floor, then take into consideration the rule that 33,000 lbs. raised one foot high in one minute, is equal to 1 H.P. This will enable you to get the required power.

(5) J. M. W. Grinnell, Iowa, asks: 1. Can I burn the smoke under our boiler by building a partition on top of furnace bars to the bottom of boiler and firing on one side of it, and in ten or fifteen minutes fire the other side? Will the heat of the one burn the smoke of the other, or not? 2. Is there any locomotive that you know of so constructed as to burn its own smoke? If so, where? 3. If not, would an invention that would do so be in demand? A. 1 There are a number of patents on smoke-consuming furnaces, therefore it would be well for you to send us a sketch of what you desire to use, and we will advise you. 2. The Fulton automatic gas-consuming furnace, is being applied to locomotives to some extent, and is claimed to be successful in consuming the smoke. 3. An invention that will effectually consume the smoke and gas in furnaces is certainly both economical and desirable.

MANUFACTURES.

The Brown & Van Arsdale Manufacturing Company, of Chicago, are to build a large addition to their works.

The Garden City Spring Works, of Chicago, are to immediately erect a 50-foot addition to their establishment.

The Enterprise Boiler Works, of Chicago, contemplate erecting a new boiler house this fall.

Conrad Kattentidt is about to take possession of his new boiler works at Chicago.

A broad silk factory is reported about to start in St. Hyacinthe, Canada.

Timothy Vinton, paper manufacturer, Brattleboro, Vt., has been resetting his boiler with the Jarvis furnace.

The Pepperell Mills, Biddeford, Me., are setting two boilers with the Jarvis furnace.

The Pocasset (Mass.) Iron Foundry, recently destroyed by fire, is to be immediately rebuilt.

Nahum Johnson is introducing steam power into his factory at Brockton, Mass.

J. A. Robinson has commenced work at his baby carriage manufactory at South Amherst, Mass.

Work is progressing rapidly on the new mill of Eaton & Wilson, at Medway, Mass.

Mr. Cummings, shoe manufacturer, South Berwick, Maine, is to erect a large factory at that place, which will employ 50 hands.

A new stocking factory is about to go into operation at Tilton, N. H., and will employ from thirty to forty hands.

F. R. Woodward has commenced work on the foundation of the new glass cutter factory at Hill, N. H.

G. S. Crosby, formerly engaged in the iron trade in New York and Connecticut, will soon commence business in the new iron foundry erected by Magee & Buckelew at Upper Jamesburg, N. J.

Paterson (N. J.) has fifty-five silk mills, twenty-six of them being engaged in the manufacture of dress silk. Another is in process of erection.

Babcock & Wilcox, 30 Cortlandt Street, New York, have lately received an order for a 450 H. P. Water Tube Steam Boiler from the great Studebaker Wagon Works, South Bend, Ind., being the third order for B. & W. boilers from the same establishment. Their water is usually destructive to a boiler, but after using these water tube boilers eight years they are still in good order. B. & W. also have an order for a 500 H. P. boiler for the Erie Elevator, and are putting in one of 150 H. P. at Columbia College, and one of 400 H. P. in a Brooklyn oil refinery. They have lately sent one of 200 H. P. to Cuba, one of 75 H. P. to San Domingo, also one of 250 H. P. and another of 200 H. P. to Philadelphia.

Major John C. Paul, late of Swissvale, Pa., is making arrangements to start a new car shop at Minneapolis, Minn., and will probably begin work this month.

The Lehigh Valley Railroad are to erect new shops at South Easton, Pa. A round house 300 feet in diameter is to be built, and will have seventy-five pits for locomotives. The erecting shops, where locomotives are taken down and put up again, will be 225 feet by 80. The paint shop is to be extended the entire length and width of the present round house yards. A large and powerful engine is to be built to run the present machinery, and other new machinery will be purchased. A new foundry will be built west of the present machine shops. The boiler and blacksmith shops are also to be extended to nearly double their present size. It is stated that at least 1,000 additional hands will be employed.—*Boston Commercial Bulletin.*

T. M. Nagle is erecting a 40 x 80 feet two-story machine shop at Erie, Pa. It is expected to be running by December 1st. Mr. Nagle has been connected with the Erie City Iron Works for several years. He will produce improved engines and machinery.

Hascal Dodge is building a new paper mill at Middlefield, Mass., 150 by 40 feet, and has begun work on a two-story weaving room, 135 by 65 feet, for S. W. & C. Russell's woolen mill at Pittsfield.

Messrs. Campbell & Richards, of 607 Commerce street, Philadelphia, have had a busy summer, and it continues this fall. They have shipped one 9″x18″, one 14″x20″, one 12″x24″, one 9″x12″, one 10″x18″ engines within a few weeks past, and have furnished pumps and boilers, and have now to build one 9″x18″, one 15″x30″, one 20″x40″ engines and boilers, and are building a new and larger shop to keep up with their work.

The city of Omaha, Neb., on Monday, the 25th ult., granted the franchise for the construction of water works for that city, to the Holly Manufacturing Co. and associates.

It is now stated that $265,000, in all, has been subscribed for the Halifax sugar refinery, and but $35,000 additional is required. An appeal is to be made to the general public to take up this amount of stock in $100 shares.—*Montreal Journal of Commerce.*

The managers of the Pennsylvania Iron Works, at Ewington, Dauphin county, Pa., contemplate extending their works, at an expense of $1,000,000.

The Locomotive Works, at Lancaster, Pa., have been sold to a company of gentlemen from Wilmington, Philadelphia, and this city. Operations will be commenced as soon as possible, and at least seventy men are expected to be employed from the start.—*Lancaster (Pa.) New Era.*

Moore & Kerrick, Indianapolis, Ind., write us: "Our sales in wood-working machinery are increasing very rapidly. We have every prospect for a large fall trade. The immense crops of wheat and corn in the West will make fifty per cent. more trade than last year."

The Troy Steam Heating Co. have commenced laying pipes to convey steam through the streets. The iron pipes are first covered with hair felting, and are then run into wooden logs. These logs only lay about four feet from the surface of the ground. They intend to lay four miles this season. The boiler-house is nearly completed and is on the banks of the Hudson River, with a large coal yard in the rear. The boilers are now being made at Syracuse, and are 22 feet long, with 28 flues, 6 inches in diameter. The first boilers will be set on the Jarvis System to burn screenings for fuel. It will take about forty boilers to heat the entire city. The company intend to make a thorough job, and will do all their own piping for their customers, and guarantee it to work satisfactorily without noise or trouble. As Troy is the head center in stoves and heating apparatus, the result there will be watched with great interest all over the country.

W. T. Bate & Son, East Conshohocken, Pa., are building complete gas works, including engine and boiler, for the town of Shippensburg, Pa. This firm shipped last week, three car loads of hot water boilers and heaters to the new insane hospital building, at Norristown, Pa. They are now at work on six of their Bate's patent steam Generators, 100 H.P., for the same building.

David W. Pond, Worcester, Mass., is building two large iron planers for the Lowell Machine Shop. His business is good, and shop running full time.

The Willimantic (Conn.) Linen Co. are setting two boilers made by the Whittier Machine Co. These boilers are manufactured from "Benzon" steel, and will be set with the Jarvis Furnace.

G. G. Young, of this city, agent for Porter Mfg. Co., Syracuse, has just shipped a "New Economizer" 40 H. P. engine and boiler to the Brazilian government.

The Atlas Engine Works, of Indianapolis, employ 400 men, and the Nordyke & Marmon Co., of the same place, 250.

The Toronto Bridge Company was formed in June, with a substantial capital, to manufacture all kinds of wrought-iron railway and highway bridges. Its directors comprise Messrs. James Worthington, of Montreal, president; Arthur B. Lee, of Toronto, vice-president; Alexander Nairn; Job Abbott, chief-engineer; J. H. Bartlett, manager—the last named gentleman acting meantime as secretary-treasurer. The work will probably begin by employing fifty men.

D. Saunders' Sons, Yonkers, N. Y., are just shipping the fourth large-sized (No. 6) Pipe Cutting and Threading Machine to the same purchaser, A. M. Byers, Pittsburgh, Pa., since March last.

The Amherst, Mass., water works are to be built shortly, Goodhue & Bunie of Springfield, contractors, cost about $40,000.

Frank H. Pond has just completed an order for $10,000 worth of machinery for the Beef Canning Company, located at East St. Louis.

ANOTHER SIGN OF GOOD TIMES.—The firm of Delamater & Co., iron workers, foot of Thirteenth street, New York, have advanced the wages of their employees from twenty-five cents up on their day's pay.

New flouring mills are building at Elk Mills, Mo., Tunnel Hill, Ky., Oxford, Mich., Blanche, Texas, Fayetteville, Tenn., Granite Fall, Minn., Wheatland, Minn., Wichita, Kan., Olmstead, Ky., Browning, Mo., Fargo, D. T., Ellsworth, Kan., Comanche, Iowa, Jasper, Ga., Fairchild, Wis., Harlan, Iowa, Brunswick, Minn., Lenora, Kan., Bismark, D. T., Hutchinson, Kan., Kasson, Minn., Manhattan, Kan., Rice Lake, Wis., Fayette, Mich., and Wayside, Wis.

It is an encouraging sign of the times to be able to record that, for four months past, Mr. John Best has been running his boiler works and foundry from twelve to fourteen hours per day, and frequently until midnight. On Saturday last he shipped three engines and an immense iron tank.—*Lancaster (Pa.) New Era.*

The Phoenix Iron Co., and the Edge Moor Iron Co., have a contract for bridge work from Demarara, W. I., amounting to $175,000—an increase of $25,000 over the original order.

Machinists' and Engineers' Supplies.

Business remains good and prices on the up grade. Coe's screw wrenches have advanced from 70 per cent. discount to 65 per cent. discount.

The manufacturers of copper rivets held their regular monthly meeting Sept. 9th, but decided not to agitate the question of an advance in prices for the present, although it is claimed that the goods are being sold at a loss. This is owing to the obstreperous attitude of some of the makers, who think it is "business" to do business for fun. A return to reason upon their part in the shape of an early advance need surprise no one.

The Ansonia Brass & Copper Co., 19 Cliff st., N. Y., inform us that as yet no change has occurred in the prices of brass and copper, but that there is every reason to believe these goods will soon begin to sympathize with the general advance in other lines of business.

H. S. Manning & Co., 111 Liberty st., N. Y., are issuing a circular withdrawing all former quotations on everything. In these days of advancing prices, they don't propose to get squeezed on any ancient quotations.

Morgan & Herrick, 86 John st., N. Y., whose new catalogue we mentioned some weeks ago as in press, have the book now nearly ready.

The Worcester Machine Screw Co., Worcester, Mass., have advanced their price of set and cap screws.

L. B. Eaton, 11 N. 6th street, has taken the Philadelphia agency for the N. Y. Twisted Drill Co.'s forged twisted drills.

Tallman & McFadden, 607 Market St., Philadelphia, have added to their stock a full line of gears, castings, and parts of models.

T. B. Bickerton & Co., 12 S. 4th street, have taken the Philadelphia agency for Christoffel's boiler tube scrapers, Roberts' governors, and Biram's anemometers, and are preparihg to issue a complete catalogue of all goods sold by them.

Situation Wanted—Help Wanted.

We will publish notices suitable for the above headings, applying to any of the machinery trades, and not to exceed four lines each (32 words), at the nominal rate of twenty-five cents for each insertion.

Wanted. A situation to learn the blacksmith's trade. Address H. A. Leighton, West Newton, Mass.

A practical machinist and engineer of many years' experience as foreman and draughtsman, desires employment, or will take the agency of machinery of merit. Address "Foreman," office AMERICAN MACHINIST, 96 Fulton St.

A first class mechanical draughtsman, thoroughly practical, well educated, a fine penman and colorist, desires a permanent situation in New York, or vicinity. Can be highly recommended. Address, Draughtsman, office of the AMERICAN MACHINIST, 96 Fulton St., N. Y.

Licensed engineer and machinist desires a situation where ability and sobriety would be appreciated: 12 years' experience: good recommendations: wages moderate: city or country. Address, Stationery Store, 120 First Ave.

A Book-keeper—German, of middle age—having many years experience and knowledge of the French language, also in possession of A No. 1 references of best city houses—is open for an engagement, either as such, or in any capacity. No objection to country. Address, B., care AMERICAN MACHINIST, 96 Fulton street, New York.

Wanted a Situation by October 1st, in or near New York city, by an engineer of long and varied experience in all branches of the profession, both on land and sea. Reference if required. Address A. J. C., care AMERICAN MACHINIST.

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Also, Steam Packing of every description,
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Meteor	10	$200
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VERTICAL AND HORIZONTAL ENGINES AND YACHT ENGINES
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Send for new Illustrated Circular, giving full description, and convincing testimonials, of which the following is a specimen:

U. S. ENGINEER'S OFFICE,
PITTSBURGH, Pa., July 23, 1879.

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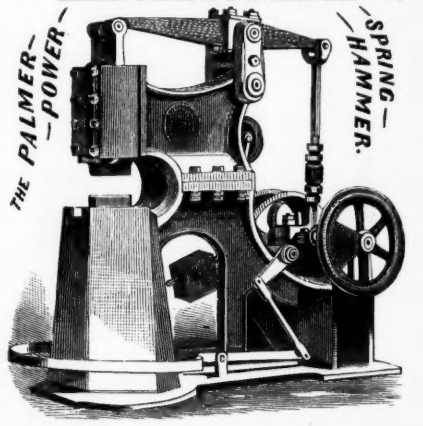

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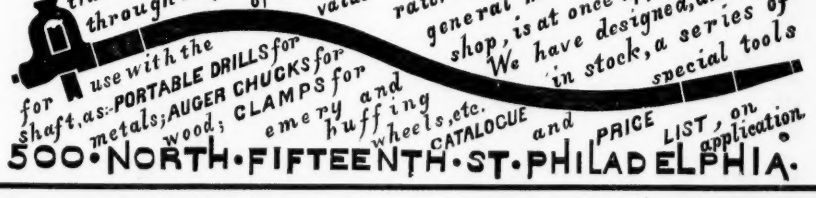
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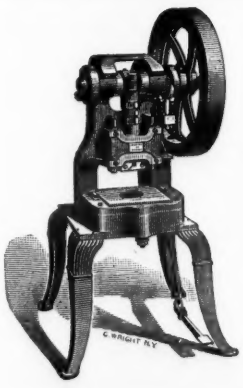

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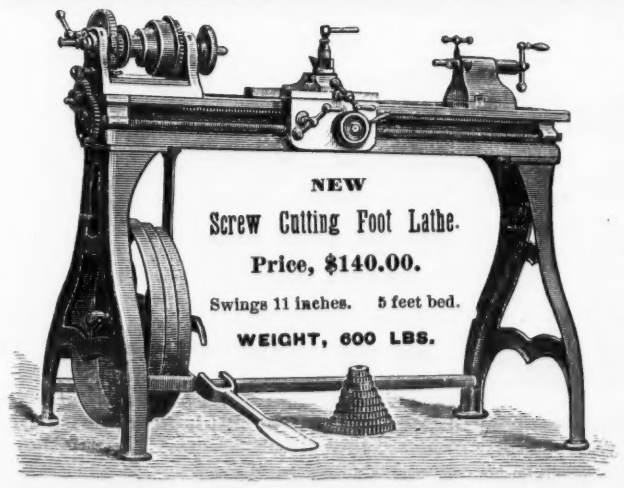

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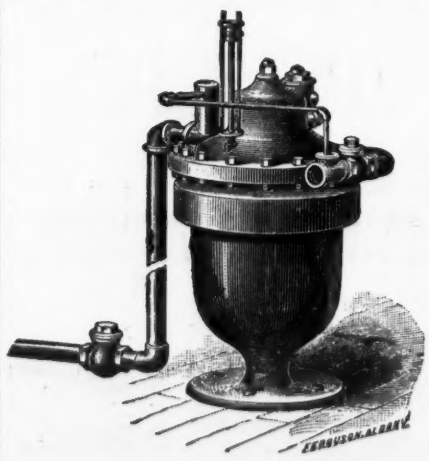

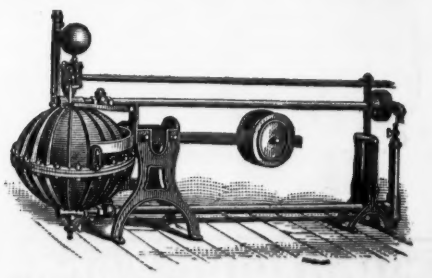

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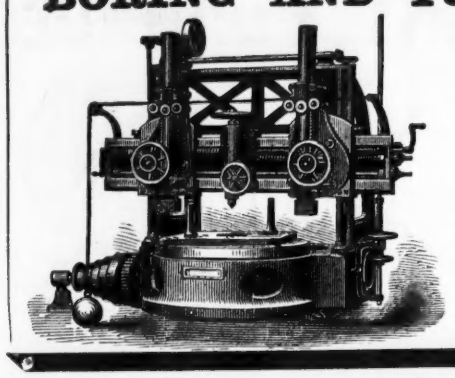

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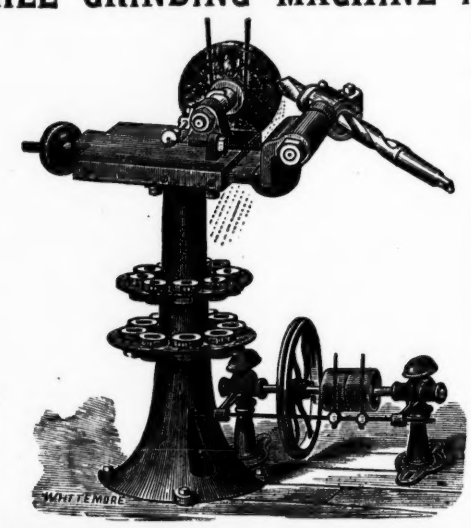

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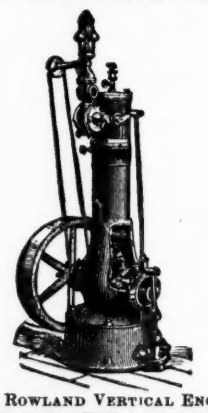

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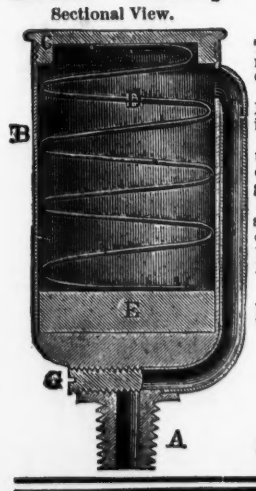

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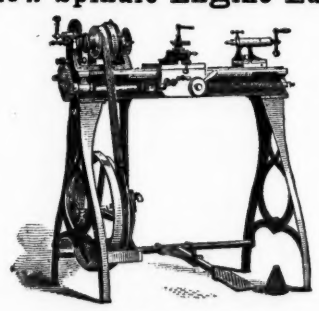

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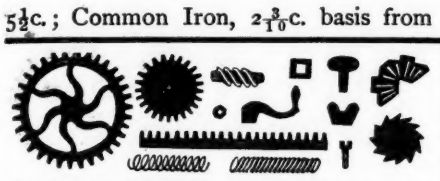

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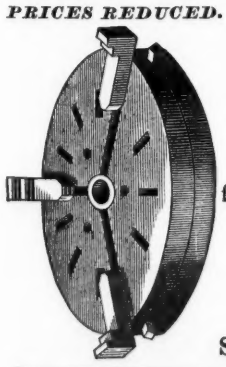

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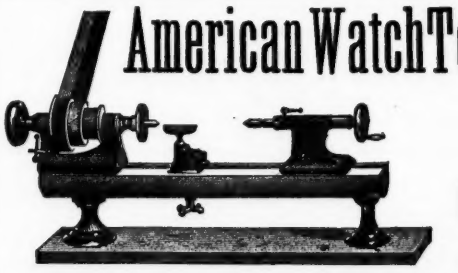

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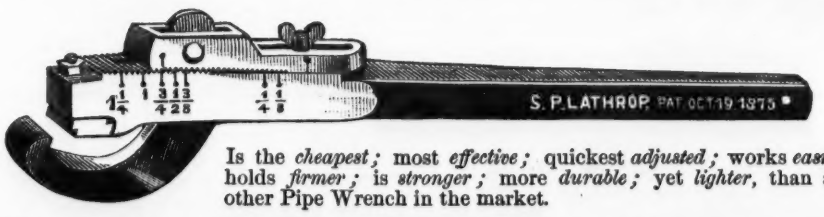

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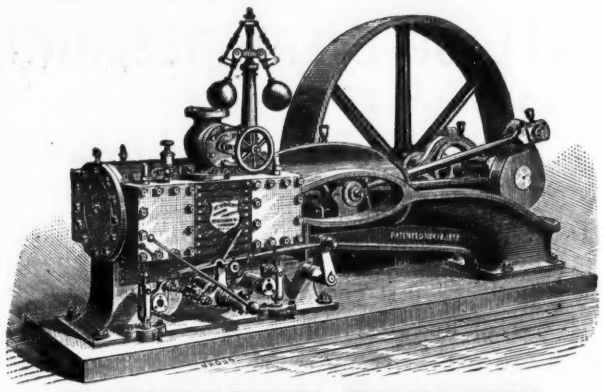

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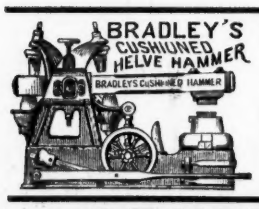

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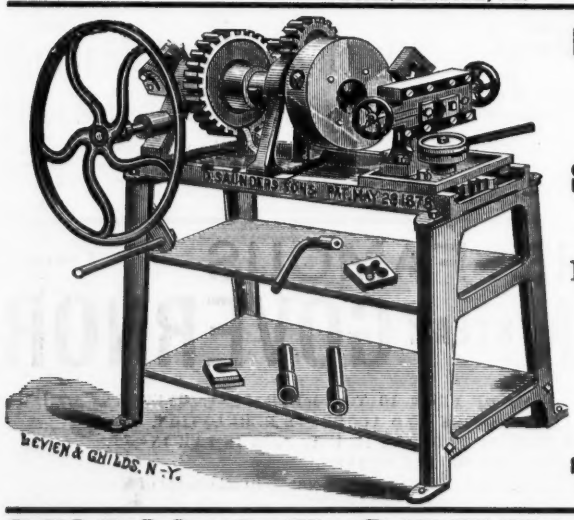

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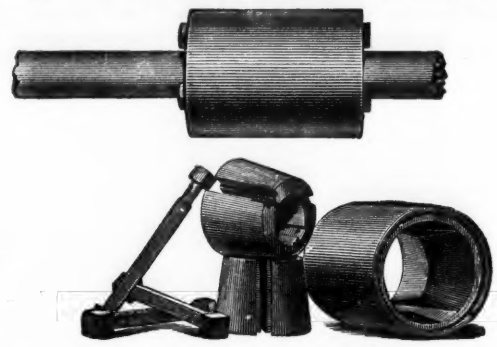

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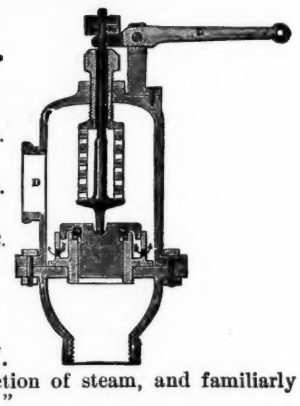

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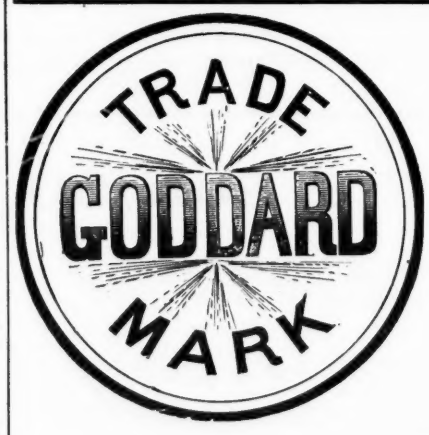

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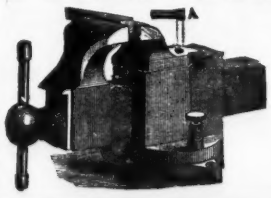

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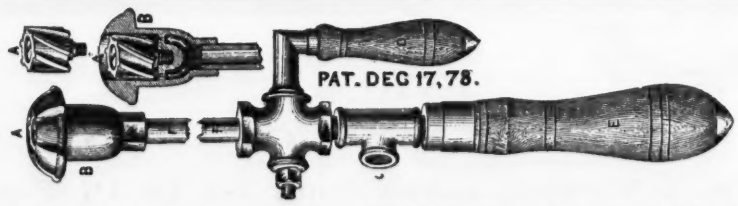

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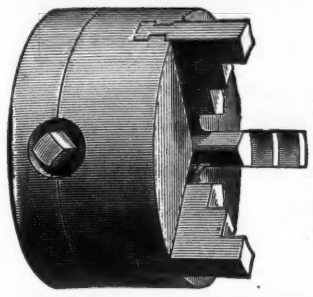

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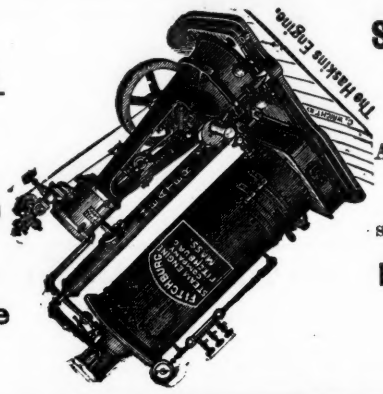

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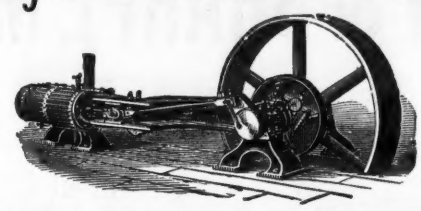

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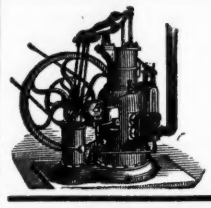

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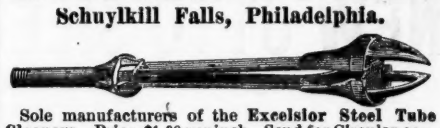

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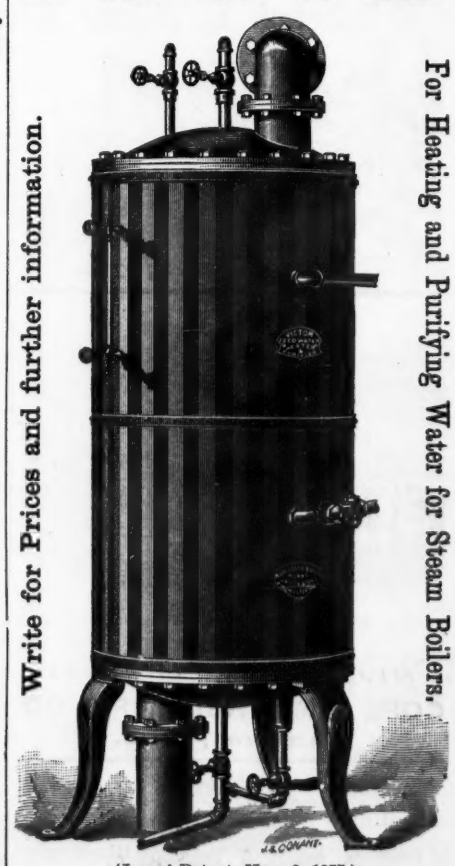

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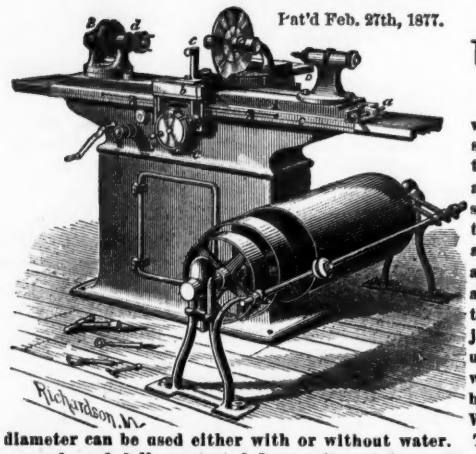

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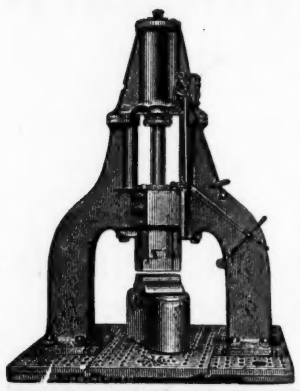

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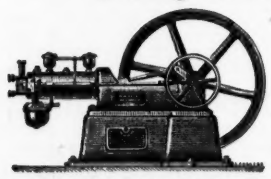

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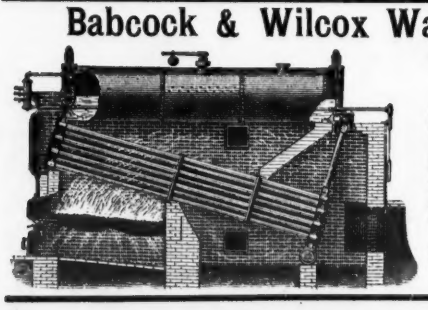

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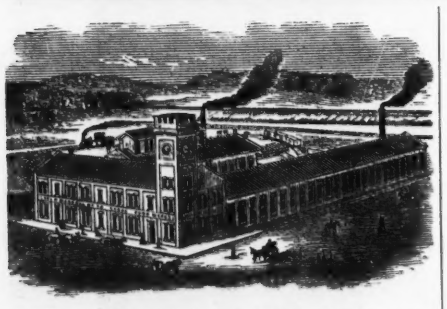

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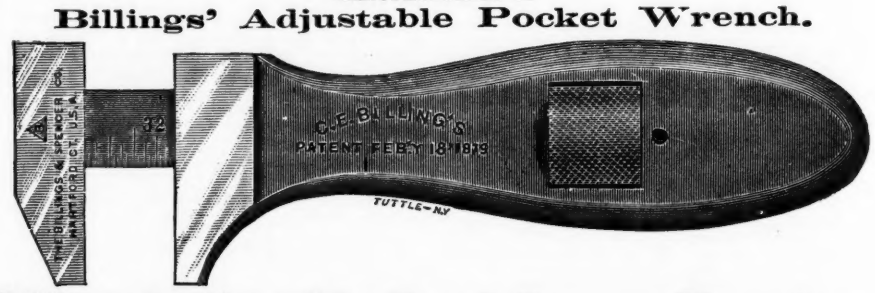

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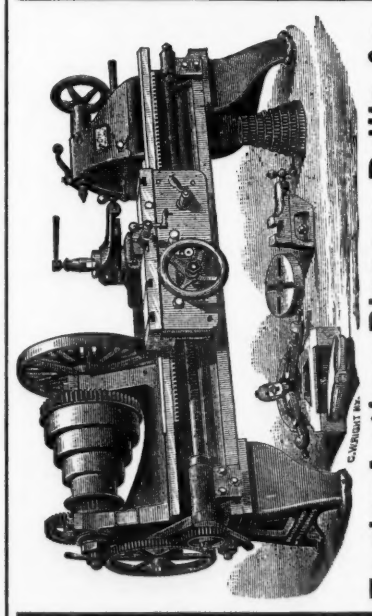

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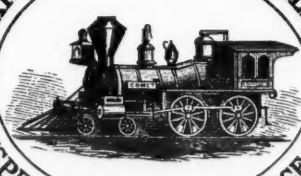

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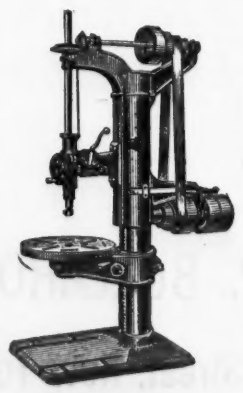

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